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AUTHOR Jamason, Barry W.
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ABSTRACT

This syllabus is intended as a multi-purpose syllabus for environmental studies in the senior high school. Some units, or parts of units, are appropriate for use in the junior high school. The units in this syllabus are: (1) The Environmental Status Quo; (2) Natural Environments; (3) Food and People; (4) Population Dynamics; (5) Energy, Part I and II; (6) Land Use and Management; (7) Transportation; (8) Pollution; (9) Environmental Health; (10) Consumer "Environomics"; (11) Global Resource Management; (12) Government, Politics, and the Environment; (13) The Environment and Careers; and (14) Summary. Each unit contains an introductory or background statement and numerous general understandings that should be developed by the conclusion of the unit. The main portion of each unit consists of procedures to be employed by the teacher. Many of these procedures are matched with one or more performance indicators to be used as guides in observing and evaluating student achievement. At the end of each unit is a list of resource materials. (Author/AJ)

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an environmental syllabus:

GRADES 10, 11, 12

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THE STATE EDUCATION DEPARTMENT
Bureau of General Education Curriculum Development
Albany, New York 12234

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FOREWORD

The way we presently live our lives has raised serious questions concerning our ability to guarantee useful, productive, and equally, if not more, rewarding lives for those who will follow us. For, in striving to continually improve our quality of life, we frequently equate this better life with the development and acquisition of material goods and creature comforts, which process seldom guarantees a critical analysis of the consequences of our actions. We often overlook the fact that our natural environment is a closed system which must be protected in order that it might replenish itself, and in so doing, us. In fact, there are elements within this system which, for all practical purposes, are not replenishable or renewable. If we consume and abuse beyond this capacity for replacement, and exhaust that which is not renewable, we jeopardize our own survival. Even with our survival secure, we may limit many options otherwise available to those who follow us.

The wisdom of our daily actions is recorded indelibly upon our natural surroundings. The mechanics of government, the rise and fall of the economy, energy politics, and individual actions in the name of the individual all exact an incredible toll upon the very system which supports us. It is all too clear that the attitudes, values, and behavior widely exhibited in society today generally lack the enlightenment and foresight that will be required to weigh present actions in terms of future consequences.

Education has an enormous responsibility for generating environmental awareness in society. Our commitment must be to make the best use of the educational resources available to us, in order that young people, as they leave the educational system and become decisionmaking adults, may be adequately prepared to assess their actions in terms of what constitutes the "good life" and how it may be achieved and maintained for the greatest number of people. This, of course, requires that people be equipped with basic analytical skills and with information about human life and the environment.

Thus, the schools must prepare young people for life in the real world of environmental despoliation, diminishing resources, and population pressures. Students must be competent to deal with the satisfaction of their basic needs while understanding, at the same time, the true scope of these needs and the way they are interdependent with the needs of society generally. It is for these reasons that schools must consider the inclusion of environmental objectives in their programs through the use of materials such as this syllabus in the ways suggested by the optional approaches described on pages 1-3. Thus, these units and instructional procedures are designed to develop new skills and understandings, and to reinforce those which have been acquired, to other areas of the instructional program.

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Members of the Department's staff who reviewed the materials and made valuable suggestions include: Donald H. Bragaw, Chief, and John Dority, associate, Bureau of Social Studies Education; Edward T. Lalor Chief, and John V. Favitta, associate, Bureau of Science Education; and, Janet M. Gilbert, associate, Bureau of General Education Curriculum Development.

Barry W. Jamason, associate, Bureau of General Education Curriculum Development, served as principal author while coordinating the efforts of those who contributed to the project. He also designed the format and prepared the manuscript for publication.

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INTRODUCTION

BACKGROUND

Environmental Studies Syllabus, 10-12 is intended as a multi-purpose syllabus for environmental studies in the senior high school. Although the major application of the instructional material herein would be at the tenth through twelfth grade levels, some units, or procedures within some units, will be appropriate for use in the junior high school.

Due to the dearth of thorough, integrated, interdisciplinary resources for environmental studies generally available, this syllabus is intentionally more detailed than traditional syllabuses. Yet, it is not so much a complete course of study as it is the flexible basis for any of a number of courses of study and/or a collection of units with a variety of uses in many existing curriculum programs. As such, this syllabus is replete with sufficient objectives, concepts, procedures, and resources for both purposes.

USE OF THE SYLLABUS

The major purpose of this publication is to provide Department-designed, Group 3 Elective* programs for credit as described in the table of options on page 3. In addition to their use in the context of a credit-bearing elective, the units will lend themselves to numerous other uses, two of which are illustrated in the table (Options 5, 6).

GENERAL DESCRIPTION OF UNITS

The 14 units in this syllabus are generally representative of the range of environmental issue categories. Three of the units (1, 13, 14) are of a general purposes nature, in that their intent is to initiate environmental study, to survey interest and awareness, to project environmental futures, and to summarize environmental learning. Six of the units (2, 3, 4, 5-Part I, 8, 9) reflect a clear orientation toward science disciplines. (The inclusion of Unit 4 in this group is arbitrary since it would quite readily serve the social studies as well.) The remaining units (5-Part II, 6, 7, 10, 11, 12) are closely related to social studies. (Unit 5 is organized as one unit by virtue of its topic, energy, but is actually two distinct units in terms of subject emphasis.) However, all units are interrelated and appropriate in varying degrees to most of the major disciplines, since the topics are the essence of environmental education and do not fall within the exclusive domain of any subject area. Consequently, any of the units, with minimal adaptation, has utility for several disciplines. Thus, the science and social studies groupings mentioned above were expedient in terms of providing direction to the development of specific procedures for each unit, and in terms of the realities of course scheduling in local districts. It must be emphasized that the unit groupings and subject area designations described above and noted on the table which follows are no less flexible than any of the materials provided in this bulletin. The nature of the environmental issues which beset us is germane to every aspect of our lives, just as every unit topic herein is germane to every area of instruction if we are faithful to the major goals of our school program.

Each Unit contains an introductory, or Background statement, and numerous General Understandings with which students ought to be familiar at the conclusion of the unit. The major portion of each unit consists of the Procedures to be employed by the teacher with the class. Many of these procedures are matched with one or more Performance Indicators (Outcomes) to be used as guides in observing and evaluating student achievement of skills and knowledge. As such, these indicators are merely intended to suggest a means by which the instructor may match the intent of the procedure with the benefits (in terms of information and skills) which the student derived from them. At the end of each unit may be found Resources for the unit in general and resources for specific procedures ([1.], etc.).

The amount of student activity suggested by each procedure in the units varies, but rarely is as little as one class period, more often requiring several class periods. As a result, there is no specific suggestion of the amount of time to be spent with each unit.

SUMMARY

The similarity of the concepts developed in the units to the conceptual basis of the regular secondary school subject disciplines reflects the curricular environmental infusion process established in earlier Department publications.** Having established in those publications the relationship of environmental objectives within the curriculum, the units in this elective course are environmental learning packages built upon the main conceptual strands of the syllabuses. However, for the purposes of this course, the concepts implied, the activities, and the procedures are organized in terms of the environmental topics (Units) rather than according to the conceptual suggestions of a specific subject discipline. In this way, the students' background in physics, chemistry, biology, earth science, and mathematics in called into play to handle the procedures in Unit 5 - Energy, Part I, for example, or, their background in the social studies, language arts, and consumer education in Units 10 and 12 as other examples.

The students should be encouraged to participate in the establishment of priorities for the selection of units and, more particularly, for the selection of procedures within each unit. The procedures suggest that more guidance than direction is required from the instructor, particularly in terms of assessing the students' abilities and previous academic experiences. This information will permit the instructor to modify units and procedures with a view toward providing the most appropriate and relevant context for the students' encounter with environmental studies.

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*See the Department publication, The Secondary School Curriculum of New York State: A Handbook for Administrators

**Living Within Our Means: Energy/Scarcity K-6 and 7-12
Designing An Environmental Curriculum...A Process Environmental Education Curriculum Infusion...Units for Grades 7-12

OPTIONAL USES OF THE SYLLABUS

OPTION	DESCRIPTION/TITLE	UNITS	DURATION	CREDIT	RELATED DISCIPLINES	COMMENTS
1	Environmental Studies Elective (interdisciplinary)	1-14	school year	1	science, social studies, and others	Group 3 Elective: science; social studies; environ. studies; or, other. Team or semester approach
2	Environmental Studies Elective	1, 2, 3, 4, 5 (Part I), 8, 9, 13, 14	semester	1/2	science	Group 3 Elective: environ. studies; science
3	Environmental Studies Elective	1, 5 (Part II), 6, 7, 10, 11, 12, 13, 14	semester	1/2	social studies	Group 3 Elective: environ. studies; social studies
4	Environmental Studies Elective (interdisciplinary)	as appropriate	semester	1/2	science, social studies, and others	Group 3 Elective: environ. studies; science; social studies; or, other
5	Mini-course, environmental studies	as appropriate	3-10 weeks		multidisciplinary	selected units to to serve as a self-contained mini-course related to any one of the major disciplines
6	Environmental Unit Modules	as appropriate	1-3 weeks		multidisciplinary	individual unit models to be infused into existing disciplines

UNIT 1: THE ENVIRONMENTAL STATUS QUO

Background

No nation has abused its environment more extensively than America. In 200 years, the people of the United States have surpassed most of the industrialized nations of Europe and Asia in the degradation of their land, air, and water while striving through the years to continually improve the quality of life at the expense of the environment. We have been inattentive to the impending crisis. Few presidents after Theodore Roosevelt gave noticeable attention to the environment until President Richard M. Nixon, pressured by a popular demand for action, declared the 1970's to be the time when "America pays its debt to the past by reclaiming the purity of its air, its water, and our living environment."

In the 1930's there had been some concern over land abuse; in the 1940's, about the availability of water; in the 1940's and 1950's, over air pollution; and in the 1960's, over pesticides and solid waste. As the first "Earth Day," April 22, 1970, signaled the advent of the decade marked for environmental recovery, who provided the leadership? It was not our President, or our government, but other concerned Americans - writers like E. B. White ("These Precious Days," The New Yorker magazine, 1959) and Rachel Carson (Silent Spring, 1962) whose earlier writings were rediscovered and became the rationale for the environmental activism of the 1970's. Soon, professional ecologists and governmental leaders supported the movement, and continue to do so now that the decade is more than half over. Where are we in this environmental crisis? This unit and the ones that follow may provide a means to discover the answer. Further, and equally as important, the individual student may develop an environmental ethic and have it manifested in daily life.

General Understandings:

- We currently face the prospect of endangering our chances of a better life through the very measures we employ to achieve it.
- Although much needs to be done to improve and preserve our environment, we must stop occasionally and acknowledge the gains that are being made in these directions.
- There has been a failure of individuals to relate environmental misuse and deterioration to personal lifestyles, choices, and individual actions.
- Government has been typically slow in recognizing the imperative for environmental planning and management.
- The environmental condition is a mirror of society's values.
- Environmental education is:
  - a new approach to teaching and learning about human relationships to the environment: how humans affect, and are affected by, the world around them.
  - experienced-based learning, using the total human, natural, and physical resources of the school and surrounding community as an educational laboratory.
  - an approach for developing self-reliance in responsible, motivated members of society.
  - an interdisciplinary approach that relates all subjects to a whole-earth "oneness of purpose."

Procedures	Performance Indicators* (Outcomes)
1.] Provide the students with the following list of concerns faced by the people of our Nation. Ask them to briefly study the 18 problems and then to number them in rank order from the most serious (1) to the least serious (18). (Consider having students devise the list.) ( ) Communism ( ) Crime ( ) Drugs ( ) Economy ( ) Education ( ) Energy Shortage ( ) Foreign Policy ( ) Health Care ( ) Housing ( ) Integrity in Government ( ) The Aged and Aging ( ) Overpopulation ( ) Pollution ( ) Racial Discrimination ( ) Taxes ( ) War ( ) Welfare Reform ( ) Women's Rights	Explain and illustrate the mechanics of a simple classroom poll.
Direct each student to justify, by listing reasons, the five most serious concerns cited. Now prompt a discussion by the entire class by employing these questions: • What is the consensus of the class regarding the 18 concerns? The five most serious concerns? • Do the reasons given justify these five most serious concerns? • How many of the 18 concerns are environmentally related? How many of the five most serious concerns are environmentally related? Explain.	Determine consensus and discuss its significance.
Direct the students to convert the results of the classroom poll to percentages in a manner similar to that used by major pollsters. • Are the results of this poll valid? Explain your response.	Develop statistics.
• How are the Gallup or Harris polls conducted?	Discuss the meaning and reliability of national polls.

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*See Appendix, p. 219.

Procedures

2.] Use the list of environmental issues provided here as an inventory of the students' relative concern for each by having them rank the issues from the most serious (1) to the least serious (12). Discuss with them their reasons for these rankings.

( ) Chemical, Biological, and Radiological Contamination (pesticides, detergents, pests, diseases, radiation)

( ) Consumerism (advertising, status products, poor information)

( ) Economic/Social/Cultural Environments (lifestyles, housing, poverty, jobs)

( ) Energy (reduced resources, excessive demands)

( ) Health (pollution effects, drugs, stress, food additives)

( ) Land Use (abuse, poor planning)

( ) Natural Environments (destruction of wildlife habitats, extinct and endangered species)

( ) Pollution (air, water, noise, visual/aesthetic)

( ) Population (distribution, density, growth rate, food supply)

( ) Resources (lack of recycling, loss of renewable [soil, water, forests, wildlife] and nonrenewable [minerals, fossil fuels] resources)

( ) Solid Waste (lack of recycling, poor disposal methods)

( ) Transportation (congestion, lack of safety, need for mobility)

- Is there a consensus among the class members regarding the 12 issues?
- How many of these issues are interrelated? Briefly describe several of these interrelationships.

Performance Indicators (Outcomes)

Assess your own perception of the seriousness of environmental issues.

Define consensus.

Procedures

Direct the students to convert the class results to percentages.

- How reliable are the results of this classroom poll?

In cooperation with the teaching staff, have the students conduct a similar "Environmental Concerns Poll" with a larger population of people: all the science or social studies students in the school; members of the community; etc.

3.] Prepare, for student use, copies of the Knowledge Inventory found in the Appendix (p. 201). These items, keyed as they are to Units 2-12, are designed to provide a measure of the students' present knowledge of environmental issues and information. You may wish to use the results in the following ways:

- as baseline data for comparison with scores at the end of the course (the inventory is repeated in Unit 14)
- as an indicator of the effectiveness of the units in terms of cognitive achievement
- as a guide to aid teacher and students in selecting units to be studied

If unit selection by teacher and/or students has already occurred (possibly through the use of the inventory in Procedure 2.]) you may wish to use only the inventory items which apply.

4.] Use a chart similar to the one on the next page with the class as a means of dealing with the concept of environmental impact. The suggested projects will give students an idea of the range of human activity which affects the environment which is represented, in turn, by the areas of impact listed in the left-hand column.

Ask students to fill in the chart using the symbols in the key below:

+ = a beneficial effect is anticipated for the environmental characteristic noted (e.g., improved transportation (11.) under column (H), airport expansion)

- = an adverse environmental effect is anticipated (e.g., noise levels (3.) increase and thus are adversely affected under column (H), airport expansion)

Performance Indicators
(Outcomes)

Conduct an environmental opinion poll with a large number of participants.

Describe numerous ways of assessing environmental impact.

Project → Impact ↓	A. Sewage Treatment Plant	B. Highway Construction	C. Apartment Complex	D. Tract Housing	E. Shopping Center	F. Nuclear Power Plant	G. Zoning Change: Commercial to Agricultural	H. Airport Expansion
1. Air Quality								
2. Water Quality								
3. Noise Levels								
4. Natural Habitats								
5. Mineral Deposits								
6. Solid Waste								
7. Contaminants (radioactive; chemical, etc.)								
8. Water Table								
9. Topography								
10. Aesthetic Quality								
11. Transportation								
12. Scenic Areas								
13. Economic Condition								
14. Population Density								
15. "Quality of Life"								

Procedures

Performance Indicators (Outcomes)

0 = no appreciable change anticipated (e.g., water table (8.) under column (H), airport expansion

Once decisions have been made for every impact feature in a project column, a simple comparison of + and - responses will suggest whether or not the project seems feasible. Many students will wish to qualify some of their decisions, particularly those using the symbol 0. Comments of this nature may be added on another sheet by simple references such as H.11., H.3., H.8.

This exercise should be repeated in Unit 14, at which time you may wish to ask students to particularize the Project column headings to specify issues and projects in their own community. Having completed work in a number of units, they should be considerably more informed and logical when justifying their decisions about environmental impact.

5.] Have each student compose an "environmental ethic" after a brief review of the 12 environmental concerns cited in Procedure 2. The statement should consist of:

- the students' personal assessment of the status of these concerns today in our nation.
- differentiation between a right and a responsibility.
- listing of at least five "environmental rights."
- listing of at least five "environmental responsibilities."
- personal assessment of the worth or value of the natural environment.
- indication of the importance of our modern, technological way of life.
- prediction of the eventual solution to the environmental crisis in general.

After they have prepared and submitted their writings, inform the students that they will be asked to review their comments at the conclusion of the course File the "environmental ethics" for use in Unit 14.

Distinguish between a right and a responsibility and cite five examples of each as applied to the environment.

Procedures

6.] In the Appendix (p.205), there is a selection of reading references which have been developed as case studies. They may be used by students as issue samplers or introductions to the kinds of topics covered in an environmental elective. Students might select one on the basis of title appeal and from the clues to content provided by the attendant questions. They should locate the reading reference; read the article; prepare a brief oral report on the issue; and, as a summary to the exercise, report to the class on the reading, involving them in answering the accompanying questions.

On the other hand, you may wish for the students to use these readings in the context of the Units to which they are most closely related. These relationships are indicated in the Appendix.

You may wish to locate the articles yourself, copy them, and make them available as a collection of supplemental reading references for class use. Obviously, many additional articles, which readily suggest discussion questions, could be added, making the collection a topical, timely resource.

Performance Indicators
(Outcomes)

Synopsize topical readings and report orally.

Resources

A Better Way To Live. Filmstrip, tape, guide, script. Albany, NY: New York State Education Department, 1972. [5.]

DeBell, Garrett, ed. Environmental Handbook. New York: Ballantine, 1970. [2.]

Designing An Environmental Curriculum ... A Process, Appendix C - Environmental Concepts, p. 41. Albany, NY: New York State Education Department, 1975. [5.]

Designing An Environmental Curriculum ... A Process, Part II — The Process, p. 7. Albany, NY: New York State Education Department, 1975. [1.], [2.]

Douglas, William O. A Wilderness Bill of Rights. Boston: Little, Brown, 1969. [5.]

The Environment — Challenge of the 70's. 6 tapes, guide. Washington: Washington Tapes. [1.]

Environmental Education Curriculum Infusion Units for Grades 7-12, An Environmental Bill of Rights, p. 132. Albany, NY: New York State Education Department, 1975. [5.]

Resources

Fortune Editors. *The Environment: A National Mission for the Seventies*. New York: Harper and Row, 1970.

Handbook of Environmental Education Strategies. Albany, NY: New York State Education Department, 1972.

How Did We Get Here? 18 min. film, color. Albany, NY: New York State Education Department. 1971. [4.]

ISCS. *Individualizing Objective Testing*. Morristown, NJ: Silver Burdett, 1973. [3.]

Piburn, Michael D., *The Environment: A Human Crisis*. Rochelle Park, NJ: Hayden, 1974. [1.]

"The Population Institute's Cartoon Contest Winners," *Sierra Club Bulletin*, June, 1976, pp. 28-31.

Roloff, Joan G. and Robert Wylder. *There Is No "Away" — Readings and Language Activities in Ecology*. New York: Glencoe Press, 1971. [1.], [2.]

UNIT 2: NATURAL ENVIRONMENTS

Background

Understanding the characteristics of natural systems in the environment is a prerequisite to identifying and understanding basic ecological concepts. It behooves us to witness normally functioning environments in which the many living individuals must interact, change, and adapt in order to survive. Interdependence is a given; no organism can live alone - especially the human animal. In order to better understand the complex, dynamic equilibrium of nature on their own terms, humans "designed" the ecosystem. It is through this basic unit of the environment that interacting populations of living things relate to the nonliving environment to obtain and to cycle the materials and energy essential for life. However, while humans can be welcome participants in the processes of the natural environment, all too frequently they are responsible for deplorable environmental conditions, such as those attributable to the extinction of a number of species of plants and animals. On the positive side, humans have attempted to sustain the natural environment through the maintenance of wildlife refuges (habitats), the necessary control of some wildlife species (hunting), and by taking action to reduce society's intrusions upon the natural environment.

General Understandings:

- The Earth's main source of energy is the sun.
- In Nature, there is a continuous recycling of many elements.
- Any one of an environment's components, such as space, water, air, food, or energy, may become a limiting factor.
- Living things are interdependent with one another and with their environment.
- Organisms and environments are in constant change.
- Survival of an organism depends upon its ability to adjust to its environment. Each kind of organism represents a collection of adaptations which fit it for survival under a given set of conditions.
- Diversity is a key factor in the survival of an ecosystem.
- Energy is initially supplied to an ecosystem by the activities of green plants.
  The basic function of any ecosystem is to capture and transfer energy.
- The energy requirements of humans are met primarily by "food," and we are dependent upon other organisms through food chains and food webs.
- Humans change the natural environment to the extent that many species find it difficult to adapt to new conditions.
- Opportunities have been provided for humans to experience and enjoy nature.

Procedures

1.] Levels of Life. Divide the class into groups of three, providing each group with the materials to make a simple terrarium: 50 ml beaker, plastic cover, rubber band, humus soil, a simple green plant (e.g., moss), and

Performance Indicators
(Outcomes)

State in proper sequence the 16 levels of organization comprising the living

Procedures

several small animals (snail, insect, etc.). Direct the students to make their terrariums operational. Referring to the list below, ask them to identify as many of these components as possible in their miniature ecosystems. Encourage them to use their knowledge of biology.

- Atoms
- Inorganic molecules
- Large organic molecules
- Nucleic acids
- Chromosomes
- Viruses
- Cells
- Tissues
- Organs
- Systems
- Organisms
- Populations
- Community
- Ecosystem
- Biome
- Biosphere

Note: Since several of the above are impossible to identify in the terrarium units, advise the students to assume their existence.

During the session, introduce ecology, the science of the natural environment, and the study of population, community, ecosystem, biome, and biosphere. At the conclusion of the group effort, elicit student input in defining each.

2.] Nonliving Essentials. Direct the students to reexamine their terraria to identify the energy and physical (abiotic) factors which sustain and promote the life therein. Ask each student to select an animal organism, and to discuss the special characteristics of each of the following essentials for the survival of that animal: water, soil, temperature, light, inorganic materials (minerals), atmosphere (oxygen), and space. Repeat this procedure with a green plant.

- Which of the factors are directly dependent upon the sun's energy?

Urge the students to estimate the limiting effect of each of the aforementioned abiotic factors, one at a time, on the animal organism. Repeat with the green plant.

Prepare for the students a "Physical Factor Data Sheet" to organize and to summarize this information as shown on the next page.

Performance Indicators (Outcomes)

world beginning with "atoms" and concluding with "biosphere."

Identify and define those levels which are encompassed by the science of ecology.

Explain and substantiate that the main source of energy for life is the sun.

Describe seven abiotic factors which support or limit life in the environment.

Procedures

Abiotic Factor	Life Supporting Characteristic(s)	Limiting Effect
temperature	determines rate of metabolism for cold-blooded animals	extreme low or high temperature adversely affects animal metabolism and can result in cellular destruction

3.] Populations: The Living Environment. Prepare a worksheet for the students with sequential questions on the species and population levels of life in the environment.

- Study any living organism in your locality. Can you identify another organism with the same structural characteristics? List at least three external and three internal structures.
- Does this other organism carry on the life functions in the same way? Cite how at least five of these are performed.
- Are the male and female members able to reproduce their own kind (interbreed)? Are they usually unable to breed in nature with other organisms dissimilar in structural and functional characteristics? (If the answer is "yes" to both questions, then you have defined an animal or plant species.)
- What is the term for a group of closely related animals or plants of the same species living in a given location?

4.] Too Many or Too Few: Serious Threats to the Environment. Continue the worksheet (in Procedure 3) with the next three questions.

- If a population increases excessively, what is this conditioned called? (This condition can upset the dynamic equilibrium of the environment.)

Performance Indicators
(Outcomes)

Define species, including three characteristics which distinguish species from other levels of life (ecological subdivisions).

Define population, mentioning two characteristics as in the above.

Procedures	Performance Indicators (Outcomes)
• Define extinction. Cite specific examples.	
• What do the following terms mean? Endangered, Rare, Peripheral, and Status Unknown. Give examples of each.	Differentiate among the terms extinction, endangered, rare, peripheral, and status unknown which are used to rate the quantitative decrease of the populations of a species.
Refer to factsheets listing extinct and endangered species in New York State and the United States.	List the names of 10 extinct animal species and suggest the factors which contributed to their extinction.

5.] Populations and extinction. Involve the students in further study of declining species by having each do one or the other of the two following activities.

Operation Extinction

This activity is designed to alert students to the causes of extinction, especially those of human origin. Provide each pair of students with the following in worksheet form.

> Would you like to see a Labrador duck, eastern cougar, bighorn sheep, dodo bird or grey whale? You could find forty-four Labrador ducks - stuffed specimens in a museum. How inconsiderate of our ancestors to allow this destruction to occur! Nevertheless we are continuing the process, in spite of the efforts of conservationists, wildlife managers, laboratory researchers, and concerned citizens. Why?
>
> To better understand the extinction process we must study the specific causes. Since the positive approach to extinction has not met with great success, you are to outline a program for the extinction of any animal; the complete and

total destruction of a species and population. This will be difficult, but if our ancestors were able to do it, then we should be able to do it. Students should devise strategies similar to the following:

- habitat destruction
- indiscriminate use of pesticides
- air and water pollution
- commercial exploitation for food
- introduction of predators
- uncontrolled hunting
- vandalism

Give an oral presentation to the rest of the class.

Postmortem discussion questions:

- Why was a negative approach used in this activity?
- Why did you select the species you did?
- Are there non-human, natural causes of extinction? If so, list several.
- Are you more aware of this problem now? Explain.

The Endangered Species Protection Agency

The purpose of this simulation is to provide the students with an opportunity to consider the economic value of a species threatened with extinction. Provide the students, who will be working in groups of five, with the following worksheet:

List the names of 10 endangered animal species, five of which can be found in New York State.

> You are members of a newly formed Federal commission directed by the President to save endangered species through the administration of government funds. Below are listed fifteen North American species rated as "endangered" and an approximation of the funds necessary to guarantee their protection and survival.

Fisher	$ 500,000

Procedures

Bald Eagle	$ 900,000
Blue Whale	1,500,000
Blue Pike	150,000
Green Turtle (ocean)	300,000
Florida Manatee	1,000,000
Grizzly Bear	1,000,000
Polar Bear	250,000
Caribou	750,000
Lake Sturgeon	750,000
Musk Ox	1,500,000
Bog Turtle	190,000
Prairie Chicken	100,000
Peregrine Falcon	350,000
Mountain Gorilla	400,000

Performance Indicators
(Outcomes)

Guidelines:

- You have been granted a budget of five million dollars for a period of one year.
- After researching the economic, aesthetic, and general environmental worth of each animal, develop a system for selecting as many of these endangered animals as possible with your five million dollar appropriation. Individual species cost estimates cannot be altered.
- List your reasons for each animal selected for survival and for each animal left to probable extinction.
- Each species must be selected by at least a four-fifths vote.
- If time is available, outline how you would use the money assigned to one of your selected animals.
- Class discussion
  - Share your plan with the rest of the class.
  - Identify endangered species in New York State.

Describe the danger to wildlife species in New York State's environment.

Procedures

- Why was a monetary approach to the problem used in this activity?

Ask the students to cite those factors which control populations.

- What is biotic potential?
- What is carrying capacity?
- What is environmental resistance?

6.] Interacting Populations: A Community. Ask the class to comment on the veracity of these statements and to provide reasons for the responses:

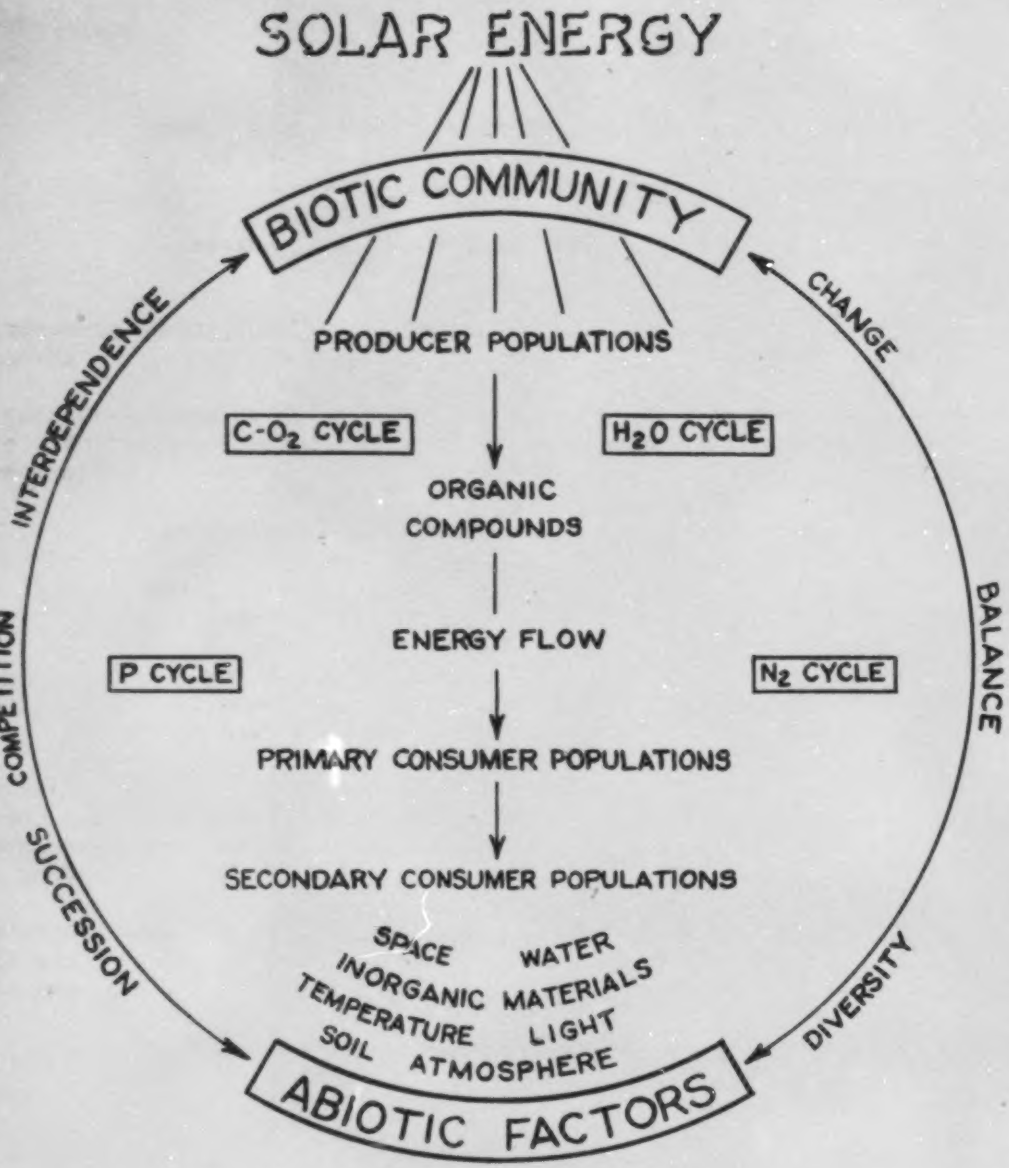
- A community unit is composed of all the plant and animal populations interacting in a given environment.
- Plant species are not essential for the successful maintenance of a community.
- A biotic community is different than a human (people) community.
- A community cannot be self-sustaining.
- Examples of communities are:
  - all the living things in a decaying log
  - the life forms in a drop of pond water
  - a herd of white-tailed deer

7.] The Ecosystem: Basic Unit of Nature. Provide the students with the "ecosystem model" on page 19. Divide the class into groups of five and direct them to seek answers to the following questions. Appoint a discussion leader and recorder for each group.

Performance Indicators (Outcomes)

Cite three biotic and five abiotic factors which regulate population size.

Define a biotic community and list five examples of this ecological component.

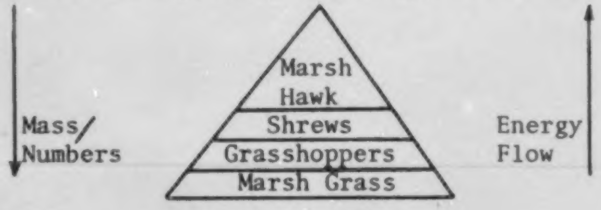

SOLAR ENERGY
BIOTIC COMMUNITY
PRODUCER POPULATIONS
C-O$_2$ CYCLE
H$_2$O CYCLE
ORGANIC COMPOUNDS
ENERGY FLOW
P CYCLE
N$_2$ CYCLE
PRIMARY CONSUMER POPULATIONS
SECONDARY CONSUMER POPULATIONS
SPACE
WATER
INORGANIC MATERIALS
TEMPERATURE
LIGHT
SOIL
ATMOSPHERE
ABIOTIC FACTORS
INTERDEPENDENCE
COMPETITION
SUCCESSION
CHANGE
BALANCE
DIVERSITY

Procedures	Performance Indicators (Outcomes)
Based upon the information in the diagram, answer the following questions. Note that several terms indicated with an (*) and four important cycles are to be positioned in appropriate locations on the ecosystem model diagram.	
• What is the ultimate source of energy for the survival and maintenance of all life in the ecosystem unit?	
• Name the two major interacting components which comprise every ecosystem.	Describe the components of an ecosystem.
• Identify the factors associated with the physical environment which are needed for the survival of the living environment. (See Procedure 2 on page 13.)	Categorize various survival factors (biotic or abiotic) of natural environments.
• Populations and communities are the major levels of life in an ecosystem. Name in proper sequence those categories of organisms which channel the sun's energy through the ecosystem unit. What is the term normally given to this transfer of energy through green plants, animals, and other organisms?	
• What is the function of decomposer populations* in the biotic community of an ecosystem? How are they involved in the energy flow of a food chain?	
Give five examples of each of the following: green plants*, herbivores*, carnivores*, omnivores*, and saprophytes*. Using a member from each of these categories, diagram a food chain. Next, construct a poster depicting a food web.	List and describe in sequence the four main components of a typical food chain. Diagram a food web consisting of at least six organisms.
Solar energy is converted to organic compound potential energy by green plants. • What is this process called?	

Procedures	Performance Indicators (Outcomes)
Herbivores are eaten by carnivores. • What is the relationship termed? • What part do scavengers* play in the transfer of energy in the ecosystem?	
Other organisms live together in a close association which may or may not be beneficial to them. • For each of the relationships below list examples of the organisms involved. Rate each organism as +, benefitted; -, harmed; or, o, not affected by the symbiotic relationship. . mutualism . parasitism . commensalism	Define symbiosis and provide three examples of this "way of life."
• What happens when two or more organisms, living in the same habitat ("address") and having the same niche ("profession"), have the same physical requirements? What is intraspecific competition? Interspecific competition? Give an example of each.	Differentiate between a habitat and a niche. Define interaction and competition.
• Explain the statements. . Complete competitors cannot exist. . If two non-interbreeding populations (different species) occupy the same ecological niche and habitat, one population will eventually eliminate the other. . Two species with identical ecological niches cannot occupy the same habitat or territory.	
The communities of two ecosystems blend together where they meet. • Describe the variety and density of life in an "ecotone."	Define the meaning and composition of an ecotone. Define territory.

Procedures

Explain the diagram below as a pyramid of energy, mass, and numbers:



- Name the producer population.
- List the primary and secondary consumer populations.
- Contrast the final, secondary consumer with the other pyramid members with respect to energy, mass, and numbers.
- Discuss the statement, "For a man to gain a pound, the sea must produce half a ton of living matter."

Study the major biogeochemical cycles outlined in the ecosystem model diagram: carbon-oxygen; water; nitrogen; and phosphorous.

- Itemize the specific chemicals transmitted to and from the different members of the biotic community by each of these cycles.
- Using lines and arrows, carefully construct each cycle on the ecosystem model diagram. Relate the essential components of the cycle to terms and information already on the diagram.
- Name a life function associated with each of the following sets of raw materials:
  - . CO_2 and H_2O
  - . O_2 and organic compounds
  - . Nitrates and organic compounds

Performance Indicators (Outcomes)

Draw and explain an energy pyramid.

Produce basic diagrams for the carbon-oxygen, nitrogen, and water cycles.

Procedures	Performance Indicators (Outcomes)
• Referring to the nitrogen cycles, state the purpose of each of the following types of bacteria: bacteria of decay; denitrifying bacteria; nitrifying bacteria; and nitrogen-fixing bacteria.	Trace the cycling of matter and the flow of energy in an ecosystem.
Summary questions:	
• What are three requirements for a balanced, stable, self-sustaining ecosystem?	State the three requirements for a self-sustaining ecosystem.
• Explain the possible effects of fossil fuel combustion on the ecosystems of the world?	
• What is the meaning of the productivity of an ecosystem?	
• Why is a normal ecosystem in a state of dynamic equilibrium?	
8.] Change and Ecological Succession. Conduct a fieldtrip to a natural area in the vicinity to visualize ecological succession. Prior to the trip:	Explain and give three examples to demonstrate the process of ecological succession.
• Present the film Succession - from Sand Dune to Forest to review the concept of change in the environment. Using the film as a reference, discuss:	Define the terms associated with succession - seres, climax community, pioneer organism, and dominant species.
. the major climatic, geologic, biotic, or technological (human) change which can alter or destroy the equilibrium of a stable community and ecosystem	
. the series of successive stages (seres) experienced by the living environment	
. the modification of the environment by each stage making conditions less favorable for itself and more favorable for the next stage	
. the eventual attainment of a climax community stage	
. the roles played by pioneer organisms and dominant species in succession	

Procedures

Performance Indicators (Outcomes)

Advise the students to review the concepts and facts of the ecosystem previously studied before embarking on the fieldtrip.

Take the students out on the school grounds to observe signs of succession in the midst of human progress, and discuss the following questions with the students.

- Does succession continue in spite of man's intrusion? Explain.
- What differences are there in succession as observed in the natural area visited and here on the school grounds?

Students should examine copies of the diagram entitled, "Death of a Pond... Birth of a Forest," (next page) and answer the questions below.

- Name the pioneer organisms for each stage.
- Identify the dominant species for each stage.
- Describe the climax community.
- Learn the label applied to the natural succession process in ponds, marshes, and some lakes.
- Cite causes of artificial or accelerated eutrophication.

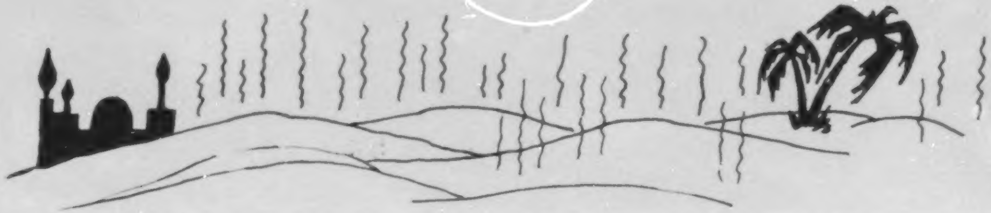
Contrast natural and artificial eutrophication.

9.] Supercommunities: The Biomes. Inform the students that they will be involved in a group project on the major biomes in our biosphere. Define a biome.

List and briefly describe the six terrestrial and two aquatic biomes comprising the biosphere.

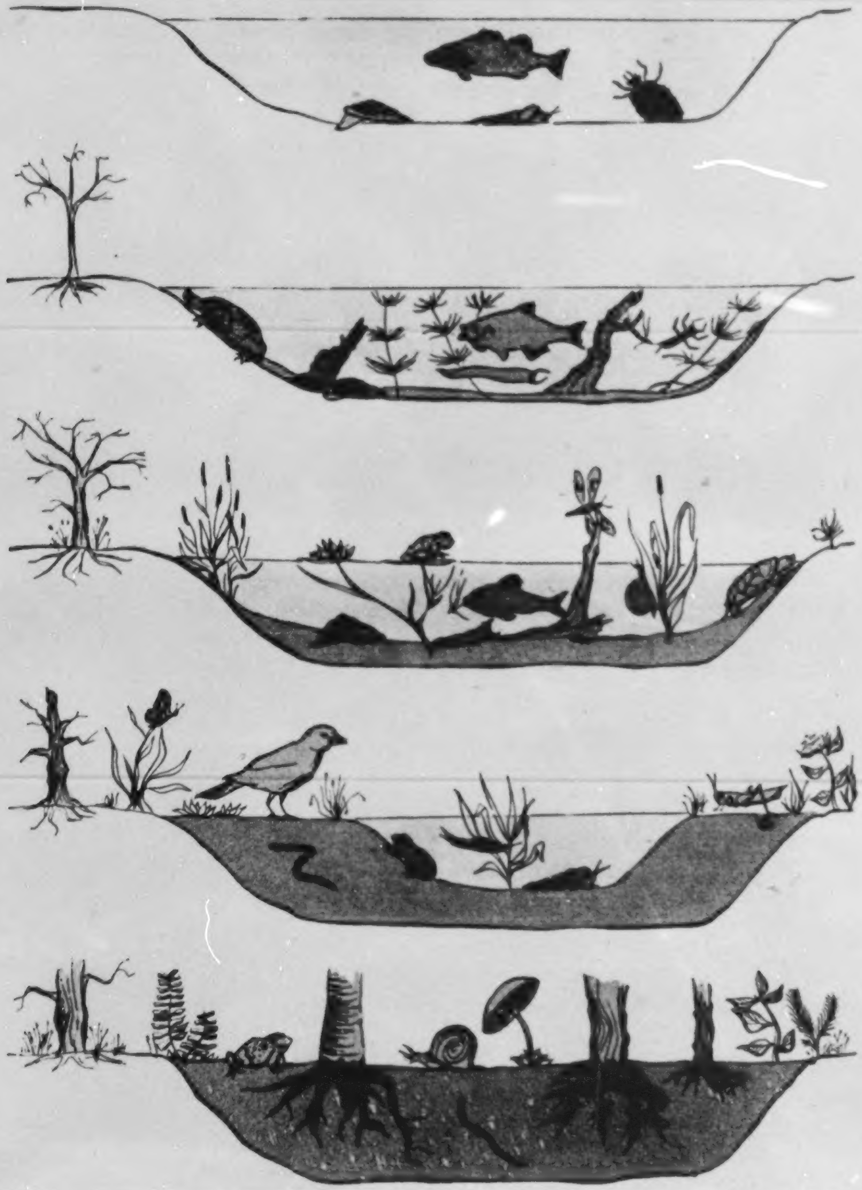
Terrestrial Biomes

1. tundra
2. taiga
3. temperate deciduous forest
4. tropical forest
5. grassland
6. desert



DEATH OF A POND...

BIRTH OF A FOREST



Modern Biology, James H. Otto, Albert Towle, Holt, Rinehart and Winston, 1965. Reprinted with permission.

Procedures

Aquatic Biomes

7. fresh water
8. marine

Organize the class into groups of three and allow each group to select one of the eight biomes listed until all have been "assigned."

Show the film The Sea to prepare them for their work. After a discussion concerning the main points in the film, provide the students with a procedure sheet outlining their project work.

Name of biome ____________________ Terrestrial ( )
Aquatic ( )

Group objectives:

- Contrast the terrestrial and the aquatic types of biomes with regard to the availability of O_2 and CO_2; absorption and retention of solar heat; amount of solar radiation; availability of H_2O; and the availability of essential nutrients.
- Describe the physical factors which determine and maintain the conditions in your assigned biome.
- Name the main life forms claiming "your biome" as a habitat.
- Cite the effects these organisms have on the physical environment of "your biome."
- Identify briefly the influence human technology and habitation have had upon the biotic and abiotic environments in "your biome."

Use library resources and your knowledge of ecology to respond in outline form to each of the aforementioned objectives. Give a 10-minute oral presentation to the class on "your biome," using the objectives as guidelines. You may wish to support your presentation with a poster, pictures, handout, model, or transparency.

Performance Indicators (Outcomes)

List at least three advantages of the organisms living in a terrestrial biome; an aquatic biome.

Explain how five physical factors influence the living conditions in each of the eight biomes.

State three plant and three animal species which dominate each of the eight biomes.

Cite five ways in which humans have changed the environment in one of the biomes.

Examples of Factors Which Can Determine Biome Conditions

- climatic zone
- O_2
- CO_2
- pH
- temperature
- solar radiation
- soil/earth crust
- latitude
- altitude
- climax vegetation
- dominant plant and animal species
- H_2O
- precipitation (in terrestrial biomes)
- transparency (in aquatic biomes)
- materials in solution or suspended salt concentration (in aquatic biomes)
- density (at 40°C) (in aquatic biomes)
- in motion ("   )

Procedures	Performance Indicators (Outcomes)
10.] Wildlife Management. Discuss with the class the ways in which humans preserve and nurture wildlife. • How are habitats managed or manipulated? • Describe a typical manipulated habitat and contrast it with one not manipulated, but simply preserved for wildlife.	Compare manipulated and nonmanipulated habitats preserved for wildlife.
Show the film, Multiply and Subdue the Earth. Plan fieldtrips to each of these types of refuges.	Give five reasons for the preservation of natural lands for wildlife, education, and recreation.
Suggest that students discuss the advantages and disadvantages of hunting, fishing, and trapping as they affect wildlife and the natural environment.	Explain the purpose of hunting, fishing and trapping from a conservationist point of view.

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UNIT 3: FOOD AND PEOPLE

Background

Two major problems and pressures face the world today: affluence and overpopulation. Most people in the United States, Canada, and Western Euorpe take food for granted. In these nations there is available an abundance of animal proteins, cereals, fruits, and vegetables at low prices. In recent years Americans have paid 18 to 20 percent of take-home wages on food. Contrast this with an average family in a developing nation where 60 to 80 percent of the take-home wage is spent on food during "normal" times, that is if the harvest has not been destroyed or reduced by drought, floods, diseases, and pests. While all will agree that the exponentially rising population of the world can outpace the current food-producing capabilities of poor nations, it is significant to note that a child born in the United States places four times as much demand on the world's food supply as a child born in a poor nation. It has been estimated that the rich nations of the world import a net gain of 1 million tons of protein from poorer countries to be used as livestock feed; certainly an unfortunate and deadly quirk of economics and lifestyles.

What can be done to insure that poor nations get an equitable share of the world's food resources? It has been suggested that hungry people may try to get food from rich nations at the point of a gun. Senator Hubert Humphrey has suggested that protein malnutrition could be offset by affluent Americans eating "one less hamburger a week." In addition he said, "In the final analysis, a fundamental moral choice cannot be evaded. Can a nation whose nutritionists proclaim obesity to be a leading health problem share its bountiful food resources with those whose very survival is at stake? When our own lifestyles affect the basic well-being of others, can we avoid making the necessary minor adjustments? A decision by Americans to eat one less hamburger a week would make 10 million tons of grain available for food assistance."

Spaceship Earth may well be facing its greatest challenge yet: feeding humankind.

General Understandings

- We must acknowledge that the interdependence of all living things dictates the manner in which, and the extent to which, resources may be used.
- The prevailing condition of scarcity which underlies all economic considerations forces changes in the lifestyles of individuals and societies.
- Most resources are vulnerable to depletion in quantity and quality.
- Choices between essential needs and nonessential desires are often in conflict.
- Earth's resources and recycling system can support only a limited number of people; therefore as populations increase and as resource supplies decrease, the freedom of the individual to use the resources is constrained.
- We must develop the technological and sociological knowledge needed to control population growth, modify environments, and alter resource use patterns.
- Historically, cultures with high technological development have used disproportionately more natural resources than those with lower levels of technological development.
- The demands of population growth, coupled with our tremendous waste of energy, are responsible for some of our more serious environmental problems.

Procedures	Performance Indicators (Outcomes)
1.] Humankind in the 21st Century. Place the following list on the chalkboard and ask students to individually select and write down the item which they think will be the greatest problem that will face humankind in the 21st century. • war • industrialization • world population • food production • violence and crime • disease control When they have made their selections, direct them to rank order the remaining items from most serious to least serious. Upon completion of the ranking, compare the lists and initiate a discussion centered on why students ranked them the way they did. Are there any other items that ought to be added to the list? If there is sufficient student interest, outside research assignments could be done on some or all of the items and reports brought back to the class regarding the worldwide significance of each problem.	Identify major worldwide problems. Make judgments about the gravity of enviromental problems.
2.] Food Preferences. Ask students to list in order the twenty foods they like to eat best, and to prepare a master list of best-liked foods from the individual lists. Indicate the foods containing high quantities of protein, fats, carbohydrates, and special vitamins. Have students illustrate the data in graph form, and/or tabular form, either on the chalkboard or on a handout sheet. Discuss the following: • What is the main reason for "liking" a given food? • Did you choose a particular food for its nutritional value? If so, what is its nutritional value? If not, why did you choose it?	Use reference texts to gather data. Display data in graphs or tables.

Procedures

- Which of the chosen foods are prepackaged? What is involved?
- Which of the foods are homegrown or are specialty items of home cooking?
- Which of the foods are essential to your well-being? Which are not?
- If you absolutely had to, which ones would you give up?
- Would you be willing to give up or sacrifice some of these foods to feed the hungry of the world? Do you think it would be "right" if you were asked to? Explain your answers fully.

3.] Nutrients. Divide the class into task groups to research the human body's daily requirement for protein, carbohydrates, fats, minerals, and vitamins.

Construct a list of typical protein-, carbohydrate-, and fat-rich foods.

Add these foods to the list if they do not already appear: brown rice, lentils, nuts, sunflower seeds, yogurt, honey, peanut butter, salmon, (other fish products), ants (other insects), shellfish, snails, cheese, milk.

Ask students, either collectively or individually, to respond to each of the questions below.

- Which foods come from cultures other than the United States?
- Are there any foods that are particularly unpopular? What are they? Why are they unpopular?
- Do you notice an imbalance to the food list? If so, how do you explain this?
- Are there some foods that other members of your family eat that you refuse to eat? Complete the following table.

Performance Indicators
(Outcomes)

Research appropriate texts for specific information. Classify information and construct tables to show data.

Organize and analyze information about foods and nutritional value.

Summarize verbal information and report it to a group.

Analyze personal eating habits and relate them to the world food situation.

Procedures

Performance Indicators
(Outcomes)

	CARBOHYDRATE	PROTEIN	FAT
Food I Eat Daily			
Food I Sometimes Eat			
Food I Have Never Eaten But Might Try			
Food I Would Not Eat			

- Why do you refuse to eat some foods? Under what conditions would you eat them?

4.] Food Chains. Explain the 10 percent rule to students. (About 10 percent of the energy at one feeding level of a food chain moves to the higher level in a food chain. Thus it takes 100 kg of corn to produce 10 kg of beef from cattle which in turn produces 1 kg of human protein. If the United States used 10 percent less meat, about 60 million persons could be fed on the grain saved.) Once students understand the rule, direct them to respond to the following.

Understand the principle and operation of a food chain.

- Describe some of the ways that energy is lost in a food chain. What happens to the energy? Where does the energy originally come from?

Relate food chain information to a given situation.

- Solve this problem. Suppose two sailors were shipwrecked on a rocky island in the winter. The island lacks soil, vegetation, and animals. The sailors saved only a crate of cereal and two hens. The sailors want to survive as long as possible. Which of the following should they do? Explain your reasoning. Suggest a better plan if you wish.

    a) Feed the cereal to the hens and later eat them, one at a time, making each last as long as possible.

    b) Kill and eat the hens, one at a time and making each last as long as possible. Then eat the cereal.

Procedures

Performance Indicators (Outcomes)

c) Feed the cereal to the hens as long as it lasts. Eat the eggs the hens lay and later eat the hens, one at a time and making each last as long as possible.

d) Eat the cereal and give none to the hens. Eat the hens when they starve.

- Explain the phrase "eating high on the food pyramid."

5.] Menus of the World. Divide the class into committees to investigate and develop menus typical of different areas and cultures of the world, such as those of the United States (or Western nations), China, India, South America, Africa, etc. Indicate the amount of protein, carbohydrate, and fat in each diet and the number of calories derived from each source in the diet.

Use library resources to investigate different cultures.

Compare the protein sources in each of the diets.

- What portion of the calories comes from proteins, carbohydrates, and fats?
- What portion of the protein comes from cereals, grains, and meats in each of the menus?
- Which of the menus is a protein conserver, and which of the diets is "high" on the food chain?
- Using supermarket prices, estimate the financial cost of each of the menus.
- A popular food chain advertises, "20 million burgers sold." Calculate the amount of protein that figure represents. Estimate the amount of grain used to raise the beef used in the burgers. (Assume 286g of protein per kg of burger.)

Given specific information and using math concepts, predict and infer an outcome based on the calculations.

Direct students to read: "Should We Cut Down on Meat to Save Our Grain Supplies," Senior Scholastic, 105: 11-15, Oct. 24, '74.

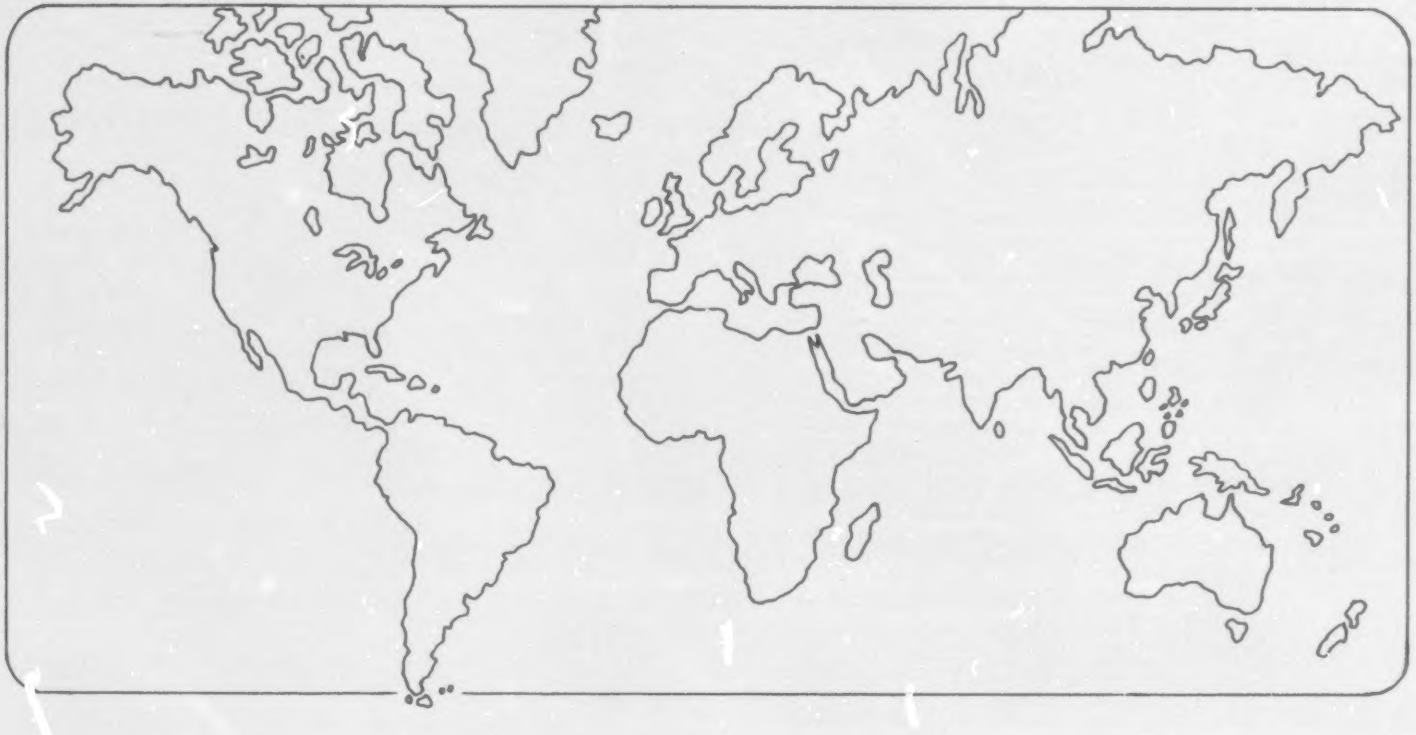
Support or refute a position using a specific text as a reference.

Procedures	Performance Indicators (Outcomes)
6.] Feast or Famine. The nutritional value of diets varies greatly from region to region throughout the world. Suggest to the students that they refer to United Nations statistics dealing with the caloric intake of people by nations and regions. Then, using the scale below, ask them to devise a color key and apply the information to the world food map on the next page.	Describe the calorie content of diets for other cultures.
• Starvation - less than 1500 calories/person/day • Potential starvation - 1500 to 1900 calories/person/day • Adequate - 1900 to 2300 calories/person/day • More than adequate - 2300 or more calories/person/day	
Once the students have completed the map assignment, use the question exercise on p. 37 to help them grasp the information therein.	
Introduce the students to the Malthusian Theory and predictions of the impending crisis of Population-Food Production. Emphasize the close relationship between population growth and food production. Determine how we can increase food production and make people aware of the needs of these famine areas of the world.	Explain Malthus' Law.
Have the students write an essay answering the following question: Why do (or why don't) the nations indulging in the feast have an obligation to regularly supply the famine-beset nations of the world?	
Check the method and type of advancement of agriculture in some of the countries mentioned on the worksheet that are experiencing famine (India, Niger, Brazil, Southwest Africa, etc.). Look at their geography and climate and the reasons for their poor diets.	Compare worldwide methods of agriculture.
Give possible alternatives to present agricultural methods, land use, and cultural dietary habits in the starving countries. Make students aware of the cost in time, money, and human effort needed to alleviate this crucial problem.	
Have students watch closely their eating habits and note those frills with which they indulge themselves. Make a list of eating habits and of foods that could be eliminated.	

FEAST OR FAMINE

A SPECIAL WORLD FOOD MAP

☐ STARVATION
☐ POTENTIAL STARVATION
☐ BELOW ADEQUATE CALORIE INTAKE
☐ ABOVE ADEQUATE CALORIE INTAKE



THE FOOD CRISIS!

USING YOUR WORLD FOOD MAP, A WORLD ALMANAC, AND A POLITICAL
MAP OF THE WORLD, ANSWER THE FOLLOWING QUESTIONS.

1. Which area of the world is experiencing the most extensive starvation problems?
2. In which area of the world is starvation affecting the most people?
3. The hunger problem, although not confined to one hemisphere, seems to be more severe in which hemisphere?
4. Those areas experiencing famine seem centered in which latitudes?
5. Name one continent which seems to have more than adequate calorie intake.
6. Name one continent where famine seems to exist.
7. Which of the starvation level areas is affected by its overwhelming population?
8. Which of the potential starvation level areas is affected by its overwhelming population?
9. Which of the continents besieged by famine is experiencing these problems because a climatic type seems to be moving further south?
10. What is that climatic type mentioned above?
11. Are the areas blessed by "feast" the grain eaters or protein eaters of the world?
12. Are these same "feast" areas the developed or developing areas of the world?
13. Which continent seems to have the most serious food problem?
14. Which country suffers most from floods and typhoons that lay waste to its foodstuffs?
15. In which category from your "food map" are most of the tropical countries found?

Procedures	Performance Indicators (Outcomes)
7.] A Family. Menu. Ask students to design a well-balanced menu for their family for a one week period. Consult a nutritionist, home economist, the agricultural extension service, or a health teacher for assistance in designing the menu. Justify the inclusion of certain items in the menu based on looks, flavor, nutritional content, and edibility.	Use reference texts to support judgments. Prepare a nutritionally sound menu.
• What are the meats and meat products used?	
• How much of the daily protein intake comes from meat?	
• What are the non-meat foods that are high in protein content?	
• What is the cost per meal for the week?	
• What is the cost per person for the week?	
• What meats could or should be eliminated in order to reduce the meat intake by 10 percent? What vegetables could be substituted for those meats? What would be the financial savings of such a substitution?	
• What percentage of intake calories comes from proteins, fats, or carbohydrates?	
8.] Food, Weight, and Health. Have students secure weight charts from the health specialist in your school and/or a doctor, nutritionist, or home economist. Then have them gather information on the age, height, body frame, and weights of individuals in a large gym class and prepare a table and graph of the information.	Determine correct weight based upon age and body size.
• How many individuals are overweight? Underweight?	
• Is it healthier (more desirable) to be overweight or to be underweight?	
• Develop an argument that worldwide food resources may/could be increased if all persons in the United States weighed their proper weights. Include the health factors involved.	

Procedures

Performance Indicators (Outcomes)

9.] Inventorying Waste. Instruct students to collect labels from various cat and dog foods and calculate the amount of protein in each can. Form teams to survey the neighborhood and find out how many pet cats or dogs there are. Calculate the amount of protein used to feed those animals (based upon an approximate, per animal, daily intake).

Relate pet population size to protein use.

- It has been suggested that there are 40 million cats in the U.S. If each cat eats 100g of fish per day, how much protein is consumed in this way? How many persons could be fed on that amount of protein?

- Discuss what would be needed to convince the American people to control the cat and dog population and channel the resultant savings in protein and money into a program to feed the hungry of the world.

Reproduce the following clipping from Newsweek magazine and distribute it to the class.

> "For his Great Dane, Hercules, publicist Earl Blackwell makes a concoction of honey, cottage cheese, and kibble and calls it 'A Great Danish.' Marisa Berenson is a vegetarian, but her Shih Tzu, King Kong, eats meat. Henry Fonda's gets his in Shih Tzu Stew, a combination of ground beef and vegetables; and song and dance girl Charo makes a special paella for her Doberman. All this, and everything else you always wanted to know about stars' pets but were too bored to ask, is in "The Growling Gourmet," a compendium of dog diets compiled by writer and photographer Ellen Graham. Pop artist Andy Warhol has less of a feeding problem than most. His dachshund, Archie, eats Quarter-Pounders from McDonald's."

Discuss the following.

- Do the people mentioned in the article have any responsibility to the starving people of the world? Explain. Do you? Explain.

Procedures

Performance Indicators
(Outcomes)

- What would you say to these people in an attempt to convince them that what they are doing is excessive?

- How would you go about mobilizing a program to convince these and other people like them that what they are doing is wrong and that the food and money spent on pets could be and should be channeled to the peoples of developing nations?

Ask the same team to survey the neighborhood to find out how much fertilizer is used on lawns and shrubs throughout the year.

- How much does the average household spend on fertilizers and/or pesticides during the year? What percentage of the total income does this amount represent?

- A farm family in a developing nation may earn less than $200 per year. What percentage of the family's annual income would be spent on fertilizer if it was purchased and used at the rate of the households in your neighborhood?

10.] Famine. Consider with the class a case study in famine. The Sahel covers 3,000 square miles of Africa. A change in lifestyle among the Tuareg tribespeople has caused massive starvation in the nations of the Sahel.

Express the interrelationship of culture, lifestyle, and ecological consequence.

- Locate the Sahel; draw a map of the area; and label the countries located in the Sahel.

Distinguish between geographical and political boundaries.

Discuss the following.

- What is the principal landform of the Sahel?

- Describe the culture of the inhabitants of the Sahel.

- How has the culture changed in recent years? What is the major influence in changing the culture?

- What ecological changes have taken place in the Sahel in recent years?

Procedures

Performance Indicators
(Outcomes)

- What has been the role of international aid in the famine problem of the Sahel?
- What are the causes of the Sahel disasters? Offer suggestions and/or ideas to prevent further Sahel disasters.

Have students research the Readers Guide to Periodic Literature for recent articles on the Sahel and write or orally present a summary of the information.

Present in written or oral form a summary of a magazine article.

11.] Research Topics: Divide the class into research teams to investigate the following topics:

- Dr. Norman Borlaug and The Green Revolution
- weather and climate changes
- fertilizer scarcity
- limitations on farm lands
- effect of energy shortages on farming
- famine-related disease such as pellagra, kwashwiorkor, and others
- new grains such as triticale, opaque-2
- aquaculture
- macrobiotics

Research topical information and relate the information to the potential for world-wide famine.

Search newspaper editorial pages, magazines, and current literature on the subject to find cartoons which depict the world food shortage and overpopulation.

- How effective is the editorial cartoon in conveying meaning to a wide readership? Ask friends and relatives if these cartoons have meaning for them.
- Are cartoons always funny or clever? Explain.

Procedures

Each student should attempt to draw a cartoon on this subject using the professional samples gathered as models.

Hold a symposia on famine and food resources with each group reporting. Each group should address itself to answering the question, "What steps must be taken to distribute food resources and prevent massive famines on Earth?"

- Have students discuss how they personally can aid the world's food supply. Consider:
  - restrict pet population
  - discontinue use of fertilizer and pesticide on lawns and shrubs, thereby making it available for farm use in underdeveloped nations
  - reduce or eliminate meat from the diet
  - eat less
  - family planning

Performance Indicators (Outcomes)

Use a drawing for editorial purposes.

Resources

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UNIT 4: POPULATION DYNAMICS

Background

Essential to an understanding of the major importance of population as an international issue is the awareness of such factors as population size, growth, rate of growth, structure, distribution, and the phenomena of radical population changes. The environmental factors influencing a population and the concurrent impact of an increasing population upon the environment need to be examined. The study of wildlife populations and their relationship with the environment provides insight into these dynamics of the human population. Census procedures are an application of the science. The effect of cultural mores and lifestyles on human populations, and consequently on the environment, must be studied. Students of population concerns must understand their roles as members of this complex, exploding population, and their individual responsibility for human impact on the environment.

General Understandings:

- The interaction of environmental and biological factors determines the size and range of species and populations.
- As population expands and becomes more mobile, human demands for natural resources increase.
- The demands of population growth, coupled with the tremendous waste of energy, are responsible for some of our more serious environmental problems.
- Earth's resources and recycling system can support only a limited number of people; therefore, as populations increase and as resource supplies decrease, the freedom of the individual to use the resources as he wishes diminishes.
- We must develop the technological and sociological knowledge needed to control population growth, modify environments, and alter resource use patterns.

Procedures

1. Introduction. Show the movie Population Ecology,[1] as a preview film. This film explains what is meant by closed and open populations; population interactions; and limiting factors which affect wildlife and human populations. It also traces the growth and problems associated with the present human population explosion. Discuss this film with the students, and indicate to them that it represents a summary of the concepts which they will study in this unit.

- Explain two effects of a population explosion.

Performance Indicators (Outcomes)

Define the terms: population; demography; birth rate; death rate; rate of growth; doubling time; migration; distribution; age structure; decline; stress; density; carrying capacity; crash and extinction.

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[1] Population Ecology. 16 min., color. Syracuse, NY: State University College of Environmental Science and Forestry.

Procedures	Performance Indicators (Outcomes)
An interesting activity which might be considered as a supplement to the procedures in this unit is the common one of "culturing a population of yeast organisms." Such an activity demonstrates factors affecting population growth, methods of counting populations, and the concept of population "crash" and its prevention.	
2.] Counting Wildlife Populations.* Provide the students with information on methods used by conservation departments and wildlife management personnel to census and sample wildlife populations. Emphasize the methods used to obtain information about wildlife.	Explain that the members of a population do not exist in isolation from the members of other populations.
Show students slides of ducks, geese, pheasants, deer, trout, and ruffed grouse while providing instruction on methods used to determine the number of each species. Stress the reasons why these animals are studied annually by the Department of Environmental Conservation.	List two assumptions made in the sampling of a population.
Direct the students to engage in a simulation exercise in which they take a census of white-tail deer, and cite the reasons for managing the deer population in New York State.*	Identify at least four reasons why wildlife populations are studied.
Take the students on a fieldtrip to a nearby woodlot, marsh, game preserve, or nature center. Have them take a census, or random sample in a pre-determined quadrant to prepare an ecological inventory of plants and animals inhabiting the region. Relate this field data to the carrying capacity of the land, and discuss the necessity of water, space, and food for the survival of plants, animals, and humans.	Cite five specific problems encountered when taking a census or random samples of various wildlife populations.
Explain that indirect evidence of a population is used to determine the presence of a population which is frequently difficult to locate. Indicate methods used for, and information obtained from, studies of animal signs, such as tracks, scats, scrapes, dens, burrows, and remains.	Demonstrate an awareness of at least three complex interactions existing among different wildlife populations.
3.] Comparing Human and Wildlife Populations. Show the students the filmstrip series "Man in the Biosphere," to provide them with relevant information relating to factors which limit human population growth, result in human population increases, and affect the physical environment.	

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*See Environmental Education Curriculum Infusion Units for Grades 7-12, pp. 110-112.

Procedures

Have the students read a study about the relationship of density and stress in wildlife and compare the study of human population problems in an area of high population density.

- Are there similarities in human and animal reactions to population pressure?

4.] Human Population Growth. Ask the students if numbers of births and deaths in the area in which they live reflect the national and world trends. Direct the class to obtain birth and death statistics from the local newspaper for a period of one week. Calculate and then graph the birth and death rates. Have them apply these statistics to the mean number of births and deaths per year. Have students find current national and world population growth information for comparison with local trends. (See the chart on the next page and refer to the Population Reference Bureau's 1976 Data Sheet for figures on all nations.)

Note: $$\text{Birth Rate} = \frac{\text{Number of Births Per Year}}{\text{Population}} \times 1000$$

$$\text{Death Rate} = \frac{\text{Number of Deaths Per Year}}{\text{Population}} \times 1000$$

The difference between birth rate and death rate per thousand, expressed as a percent, is the Annual Rate of Population Growth.

Obtain the Population Reference Bureau's 1976 data sheet for classroom use as a dittomaster or transparency master. Once the students have access to this data, discuss the following with them.

- Is there a more "representative" nation for each region than the one given in the chart?
- If so, what is it and why is it more "representative" of trends and data for the region than the one given or others in the region?
- Using figures from the data sheet, have groups of students each select a region and depict its data on a bar graph.

Performance Indicators
(Outcomes)

Describe the general tendency of a population to fluctuate as evidenced by wildlife and human populations.

Construct and read a table and a bar or line graph containing population information.

Calculate the birth rate and the death rate per 1000 persons in a population.

WORLDWIDE POPULATION DATA[1]

Region/Country	Population (in millions)	Birth Rate[5]	Death Rate[5]	Annual Rate of Population Growth	No. of Years to Double Population[3]
Africa	413.0	46	20	2.6	27
Nigeria[2]	64.7	49	23	2.7[4]	26
Asia	2,287.0	33	13	2.0	35
Philippines	44.0	41	11	3.0	23
North America	239.0	15	9	0.8	87
United States	215.3	15	9	0.8	87
Latin America	326.0	37	9	2.8	25
Venezuela	12.3	36	7	2.9	24
Europe	426.0	15	10	0.6	116
Sweden	8.2	13	12	0.1	693

[1] SOURCE: from the 1976 World Population Data Sheet, courtesy of the Population Reference Bureau, Inc.

[2] One nation, not necessarily representative, was chosen from each region

[3] $\frac{70}{\text{Annual Rate}}$ = No. of years to double population

[4] Although annual growth rate is the difference between birth rate and death rate, (see p. 46), occasional discrepancies and the result of rounding and other minor factors

[5] Per thousand

4.] (cont.)

- A recorder for each group should prepare the group's conclusions about trends, projections, and impact as indicated by the population data presented in the form of a brief oral report for the whole class.

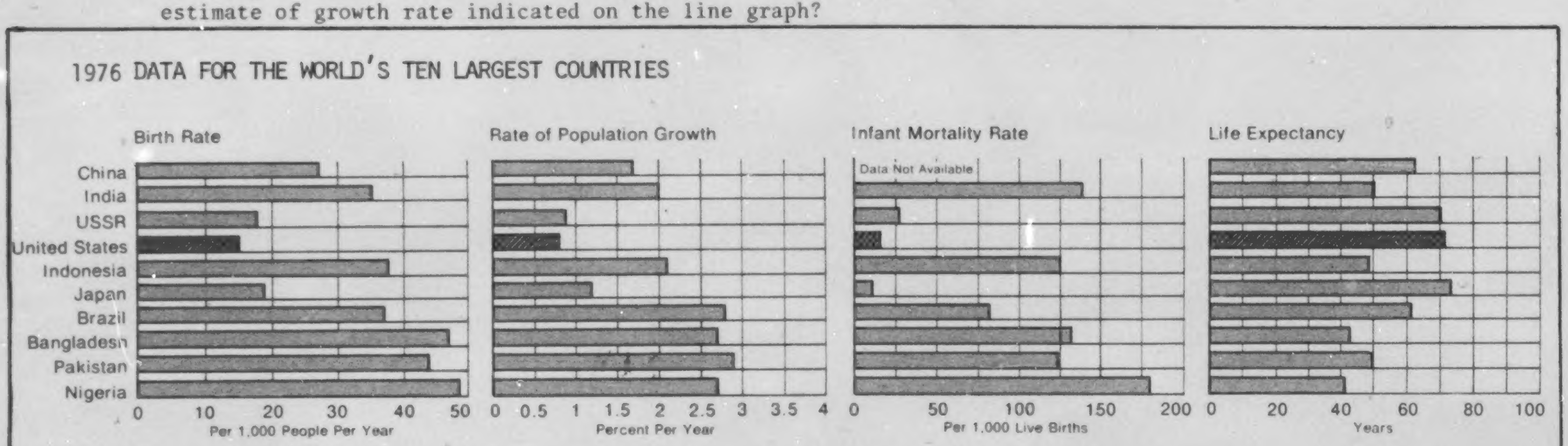
Reproduce for the students the graphs found below and on the next page and discuss with them the meaning and importance of the data presented.

- How do the factors of infant mortality rate and life expectancy affect population growth rate and total population? (See bar graph below.)

- If the infant mortality rate is low and life expectancy is high in the United States as compared with statistics of other nations on the chart, why is the United States' rate of population growth lower than that of others depicted?

- Explain why the world population growth rate on the line graph seems to be declining.

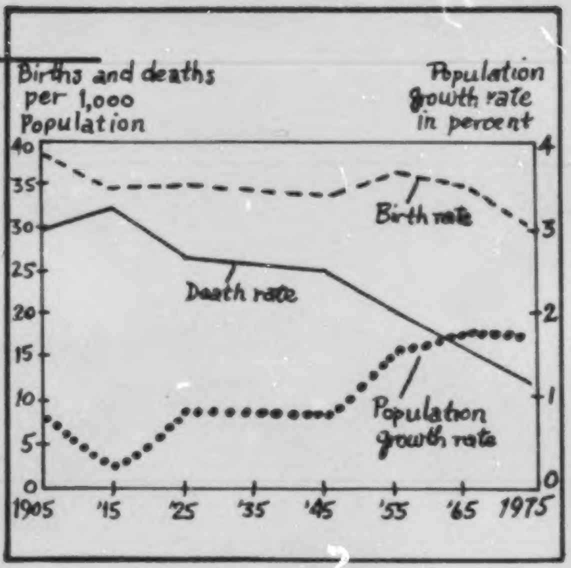
- How long will it take for the world population to double given the estimate of growth rate indicated on the line graph?



Courtesy of the Population Reference Bureau, Inc., Washington, D.C. 20036.

World Birth, Death, and Population Growth Rates, 1965 - 1974

BIRTH RATE DECLINES. Birth control programs have spread across the globe and contributed to a significant decline in birth rates in the past decade, according to a new government-financed study. The report, which noted more than two-thirds of the world's population lived last year in countries with birth control programs of some kind, said the years 1965-1975 will go down in history "as the period of world awakening to the problems of rapid population increase."



Procedures

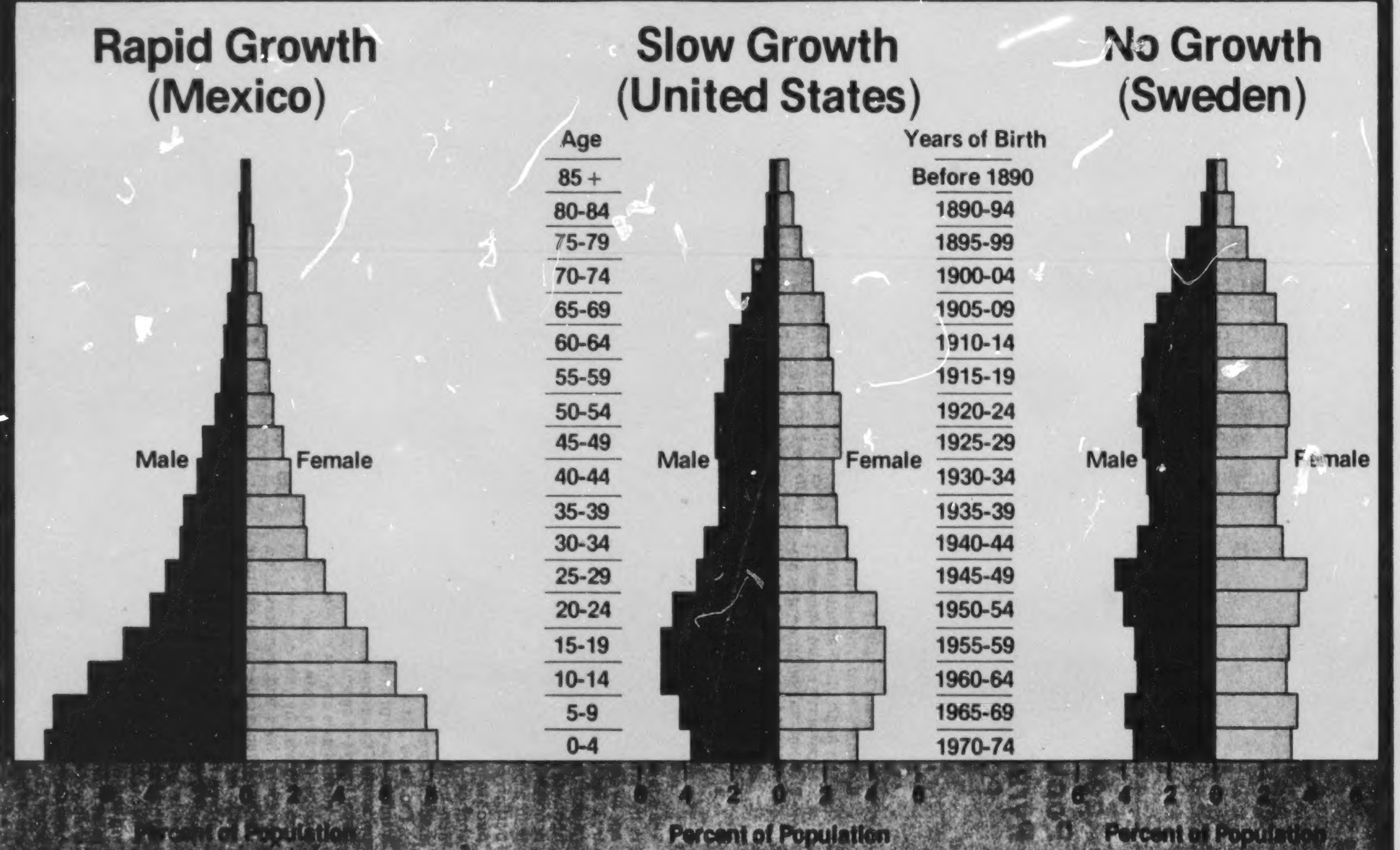
Performance Indicators (Outcomes)

5.] Tombstones and Milestones. Have the students visit a nearby graveyard. Direct them to record dates of birth and death, epitaphs, symbols on tombstones, and composition of grave markers. Explain how life expectancy, culture, and beliefs have changed during the last two centuries, as evidenced by the grave markers.

In addition to the information and insight which may be gained from such a visit, a number of other objectives might easily be incorporated into this experience. A Field Experiment in the Earth Science Syllabus Supplement, Part 1 describes in detail the approaches which may be used to study weathering, land use, soils, as well as demographic data.

6.] Population Pyramids. One way to interpret the structure of an entire population is through the study of a population pyramid. This type of graph provides a visual image of a population's age and sex structure. Study the population pryamids in the diagram on the next page. The vertical axis shows

Age-Sex Population Pyramids: Rapid, Slow, and No Growth Models



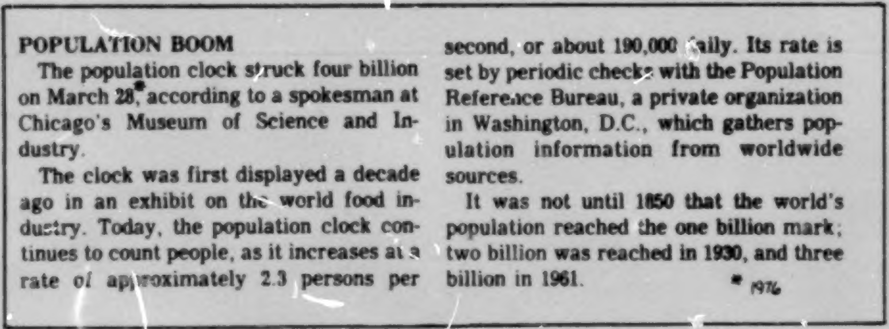
Population Reference Bureau, Inc., 1754 N Street, N.W., Washington, D.C. 20036

SOURCE: Population Reference Bureau, Inc.

50

different age groups, and the horizontal axis depicts the number of people in each age group. The percentage of males and females in the population is shown at the base. Direct the students to explain how the birth rate, death rate, survival rate, and migration can change the composition of a population and the shape of population pyramids.

Ask the students to label each country as "young" (birth rate increasing) or "old" (birth rate decreasing) and also to find other examples of each type. Then ask them to provide the social, political, economic, and environmental reasons for the characteristics of each population.



POPULATION BOOM

The population clock struck four billion on March 28,* according to a spokesman at Chicago's Museum of Science and Industry.

The clock was first displayed a decade ago in an exhibit on the world food industry. Today, the population clock continues to count people, as it increases at a rate of approximately 2.3 persons per second, or about 190,000 daily. Its rate is set by periodic checks with the Population Reference Bureau, a private organization in Washington, D.C., which gathers population information from worldwide sources.

It was not until 1850 that the world's population reached the one billion mark; two billion was reached in 1930, and three billion in 1961.

* 1976

7.] Population Trends. Direct each student to read, and prepare a report, on a selected book or short story which reflects population trends for the future.

- How is the population of the United States changing?
- How has the world environment been affected by an increasing population?
- How are individuals (humans) affected by increasing populations? Can you suggest any parallels in the animal kingdom of the effects of population pressures?

Identify and read a population pyramid.

Differentiate between the pyramids for "developed," "developing," and "underdeveloped" nations.

State four factors which cause changes in the structure of a population.

Demonstrate the relationships between the cultural mores of three different nations and their current population trends.

Cite 10 major effects of an increasing population on the environment of the United States.

Distinguish between population growth and population change.

Give five major effects of an increasing population on the individual.

Resources

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Resources

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UNIT 5: ENERGY

Background

Our Nation and the world are faced with the sobering reality of imminent and continuing shortages of that all-important commodity...energy. Many thoughtful citizens, if pressed, could admit their awareness that energy resources are exhaustible. The problem however, is that even this thoughtful segment of society is rarely pressed to keep this in mind in the absence of all but spot shortages of fuels. Somehow, the comfortable and chauvinistic (but insular) view is that fuel prices constitute a Middle Eastern "rip-off" rather than suggesting that, to a large extent, the price structure reflects increasing scarcity of the petroleum commodity. Possibly even more problematical is the realization that the above-mentioned "thoughtful citizens," whose awareness is nonetheless limited and whose concern is sporadic, by no means constitute a majority in society. Thus, large segments of the population rarely, if ever, relate their daily activities which impact on energy resources to the gravity of the situation we could be creating. As a result, we (6% of the world's population) continue our profligate use of energy (more than one-third of worldwide consumption, with little attention to how future supplies will be affected. Conservation programs can lengthen dramatically the life of these finite resources, with little inconvenience, and while practical energy alternatives are sought and developed.

It is essential that the elemental nature of energy be understood; that we be ever conscious of the effects of our activities; and that we recognize the importance of, and participate in, responsible measures and programs of energy conservation. We must also view the future optimistically, thus supporting intelligent research into new methods of providing sufficient energy for an increasing world population. In this way we may avoid the pitfall of dashing the rising hopes of billions on earth who have never benefited from a surfeit of anything but misfortune.

Energy conservation and, ultimately, a more equitable distribution of energy resources as reserves are husbanded and new and alternative sources found, can only be achieved through a thorough understanding of: the nature of energy; the way it is used (consumption and demand); the types of energy resources; and, the potential for harnessing new sources.

General Understandings:

- Energy is the ability to do work.
- When work is done on or by a system, the total energy of the system is changed since energy is needed to do work.
- If a system loses or gains energy, then an equal amount of energy must be transferred in some form to or from the surroundings.
- In any transfer of energy among objects in a closed system, the total energy of the system remains constant.
- Energy is neither created nor destroyed; it is merely changed from one form to another.
- No conversion of energy from one form to another is 100% efficient; some energy is lost or wasted.
- Energy is commonly measured in calories (the amount of heat required to change one gram of water one Celsius degree) and in British Thermal Units...(BTU's—the amount of heat required to change one pound of water one Fahrenheit degree - 252 calories equal one BTU).

- An ecosystem is self-sustaining if there is a constant source of energy; a living system capable of incorporating this energy into organic compounds; and, a cycling of materials between organisms and their environment.

- Electric power is the rate at which electrical energy is expended.

- Limited supplies of existing energy resources will force a modification in our lifestyles.

- The earth has a finite quantity of energy-producing resources.

- Raw materials and energy supplies are generally obtained from those resources available at least cost, with supply and demand determining their economic value.

- Natural resources, including nonrenewable fossil fuels, are interdependent and the use or misuse of one will affect others.

- The waste of energy resources can limit the options available to future generations.

- Natural resources are unequally distributed with respect to land areas and political boundaries, thus creating conflicts over priorities in the use, management, and conservation of these resources.

- Earth's resources and recycling system can support only a limited number of people; therefore as populations increase and as resource supplies decrease, the freedom of the individual to use the resources is constrained.

- The sun is the primary source of energy for living things.

- Energy from the sun enters living systems through green plants.

- Photosynthesis is a process in which light energy is converted into the chemical bond energy of organic compounds.

- The energy used in an electric circuit is the product of the power developed and the time during which the flow of charges persists.

- When any amount of mass is changed into energy, the amount of mass is multiplied by the square of the speed of light to determine the amount of energy that is produced ($e = mc^2$).

- The ways in which man converts energy are particularly inefficient (e.g., the internal combustion engine is only 10-12% efficient, and this efficiency is reduced by loss to friction to 5%).

- Any one of an environment's components, such as space, water, air, food, or energy, may become a limiting factor.

- Individuals should become well-informed about the best ways to manage and conserve our energy supplies, considering that choices between essential needs and nonessential desires are often in conflict.

- Resource depletion can be slowed by the development of substitutes for existing (nonrenewable) resources, prevalent lifestyles, and current priorities.

- We must develop the technological and sociological knowledge needed to control population growth, modify environments, and alter resource use patterns.
- The limited nature of productive resources makes it imperative that a society define its economic objectives in terms of environmental reality.

Procedures	Performance Indicators (Outcomes)
The procedures for this unit on energy are divided into two parts for the purpose of accommodating the instructors' backgrounds, experience, and preferences. PART I is meant to be used by senior high science teachers, while PART II is intended for high school instructors who are not science teachers.	
PART I	
1.] Discuss the definition of energy and have class members describe its many forms, (kinetic, potential, heat, electrical, chemical, nuclear, solar [light], sound) giving specific examples of each.	Define energy and give examples of each of its many forms.
2.] Define power (the rate at which energy is expended). Students may measure the power they can develop in running up stairs. The work done is the product of the student's weight, the number of steps, and the height of the risers. (The teacher should make sure that pupils doing this are in good health before allowing the trial.)	Demonstrate simply the development of power.
Point out that such a large power (in many cases more than one horsepower) can only be developed by a human being for brief and infrequent periods. Suggest that the same test attempted on the stairs of the Empire State Building, or of some tall local building or monument, would prove this conclusively.	
Have pupils calculate their power in watts by multiplying their weight in newtons by the height of the stairs in meters, and then dividing the product by the time in seconds.	
If a 165 lb student climbed a flight of stairs a vertical distance of 39 feet in 15 seconds, the power developed (horsepower) would be calculated as follows:	Using equivalent values, calculate power in terms of watts.
Multiply the weight in newtons by the height in meters;	

Procedures	Performance Indicators (Outcomes)
165 lbs = 75 kgs (2.2 lbs = 1 kilogram) 75 kgs = 735 newtons (1 kg = 9.8 newtons) 39 ft = 12 meters (approx. 39 in = 1 meter)	
735 newtons x 12 meters = 8820 newton-meters	
then, divide the product by the time in seconds:	
$\frac{8820 \text{ newton-meters}}{15 \text{ seconds}} = 588$ newton-meters/sec	
1 newton-meter = 1 joule 1 joule/sec = 1 watt 746 watts = 1 horsepower	
thus, $\frac{588}{746} = 4/5$ horsepower (approx.)	
3.] The movements of energy which characterize life activities are represented in the food chain and web. Discuss the transfer of energy in a food chain, including the concepts of producer, consumer, and decomposer. Consider these concepts in light of another... competition.	Define the terms: food chain; food web; producer; consumer; decomposer.
Elicit descriptions of the relationships of biomass of producers and consumers in typical biomes, for example: fox / deer / forest or wolf / buffalo / grassland	Define biome and provide several examples of same.
Instruct students to describe the nature of an ecosystem which has been observed on a fieldtrip, to a pond, meadow, forest, or seashore in the form of food pyramids more elaborate than the ones above.	Demonstrate an understanding of the concept of food pyramids.
• What is the essential source of energy in a natural community and how is it produced?	

Procedures

- How is energy transferred within the community or system?

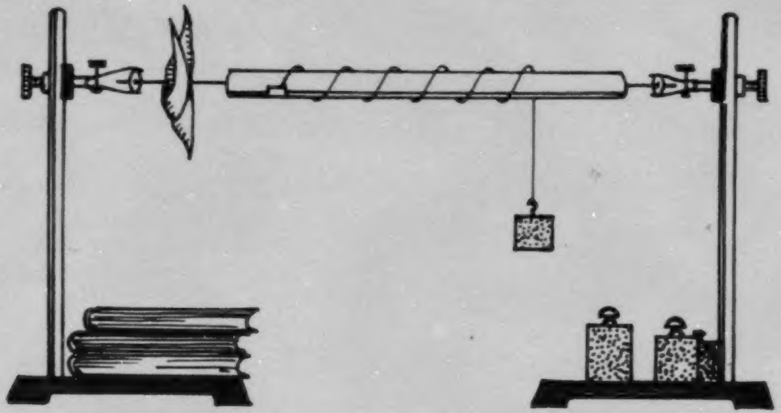
- How is energy lost in a food chain or web?

- What is the pyramid of energy?

- Does man lose or waste significant amounts of energy in the course of his various technological processes? Explain, giving examples.

4.] As an illustration of what energy is (the ability to do work), have the following experiment prepared by members of the class:

> Drive a finishing nail halfway into each end of a short wooden dowel. Attach a paper pinwheel to one of the nails with masking tape and suspend the apparatus so that the dowel rotates freely. Tape one end of a string to the stick and attach a weight to the bottom of the string. Demonstrate that work is done on the apparatus by rotating the stick with the fingers until the string is fully wound. At this point, the work done has increased the potential energy of the weight. Releasing the weight rotates the pinwheel and the original work is recovered. Show that more work can be stored and recovered as heavier weights are substituted in this demonstration. Point out that some of the work done was used to overcome friction and cannot be recovered easily.



Performance Indicators
(Outcomes)

Demonstrate an understanding of energy through participation in a classroom experiment.

Procedures	Performance Indicators (Outcomes)
• How does man's efficiency in energy use compare with nature's? (Euell Gibbons most recent book, Stalking Far Away Places, suggested ways man might profitably emulate nature's efficiency with regard to energy production and use.)	
• As to the matter of competition, are there any parallels between competition in a natural community and competition in the society of man? Explain.	Describe the elemental nature of competition.
• How does man resolve his disputes over resources and energy?	
• Reconcile (if you can) the following statement with what you know to be true about the environment, natural communities, and man's place in the biosphere. "If it comes to a choice between energy and the environment, I think we will choose energy."	
5.] A simple exercise to aid in understanding the transfer of energy is the Earth Science Investigation V-A-2a, Heat Transfer in the Earth Science Syllabus, Topic V - Energy in Earth Processes. Consider the following questions once the exercise has been completed by the class. • List ways in which heat energy is lost in your home heating system. How can these losses be reduced? • Based upon simple inquiries you might make, rate different types of home heating in the order of their efficiency. • Could major strides in the conservation of energy resources be made if we were more attentive to the way we build houses, fuel industry, and construct heating systems? Explain in detail, offering specific suggestions.	Explain the transfer of energy, citing heat loss examples.
6.] Use some sample nuclear fission reactions to illustrate the fission fragments and energy produced by such a reaction. Using the $E = mc^2$ relationship, calculate the energy equivalent of an atomic mass unit. Carry the exercise	

further by calculating the energy equivalent of the mass of a single proton converted to energy. Given the fact that a 1-gram sample of a certain radioisotope fuel produces 2 watts per gram during 8 years, calculate the energy in joules produced by the radioisotope during the 8-year period. For comparison, consider gasoline burned with air as generating 10,000 joules/gram of combustion products, and calculate the amount of gasoline and air required to equal the 8-year output of the 1 gram radioisotope.

- What are the advantages of using fission and fusion systems for producing energy?

- What are the disadvantages?

- Practically speaking, what are the prospects for fusion energy?

- Considering the availability, and future prospects of availability, of all materials used in the various exercises above, which process of creating energy is the most promising at this time? Explain.

Generalize about the comparative values of alternative energy systems.

7.] Inasmuch as we must begin considering alternatives to the use of fossil fuel for energy, it would be useful to examine the potential of solar energy.

Examine the feasibility of solar energy.

Have the pupils determine the amount of energy (from the sun) per minute that falls on a square meter of the earth's surface. (Answer: Approximately 4.47×10^4 watts)

- Where does the sun get its energy?

- How much of the sun's energy is falling on a square meter of earth for a 10-hour period?

- How much gasoline would be needed to supply the same amount of energy measured in the preceding question?

- How do photoelectric cells and solar batteries make use of solar radiation?

- What are the problems that would need to be surmounted before solar energy could supplant other types of energy on a large scale?

Procedures

8.] (The following is reprinted here with permission from the Atmospheric Sciences Research Center, State University of New York at Albany. (Norton, Thomas W., Donald Hunter, and Roger Cheng. Solar Energy Experiments for Secondary School Students.)

Introduction

Any energy-consuming device which depends on heating effects, such as incandescent lamps, toasters, irons, dryers, tube-type electronic devices, hot water and radiant heaters, consume relatively large amounts of electric energy as compared with other devices such as small motors, fluorescent lamps, and solid state equipment. Finding aternative energy sources, particularly for heating devices, is an important objective so that we can reduce the demand on our finite fossil fuel supply. Keep in mind that with electric heaters, for every one unit of energy used, three units of fossil fuel energy were required to provide that energy. This assumes that a fossil fuel electric generating plant is 33 percent efficient in the conversion of energy.

If we all were to use a solar-augmented hot water heater for our domestic needs, the fossil fuel savings would be significant as will be seen from these measurements.

The heat gained or lost by a body can be measured by the temperature change it causes, and is computed from $\Delta H = m \times s \times \Delta T$, where (m) is the mass, (s) the specific heat of the body, and ΔT is the temperature change involved. If the temperature increases, ΔH is energy gained.

When hot water is drawn from the heater for a bath or shower, water coming out of the spigot is replaced by water going into the hot water heater from the cold water supply. The more hot water used; the more energy is required to heat the water that replaces it. In addition, the water pipes will themselves absorb heat as hot water flows through and will lose heat to their surroundings. In this experiment, both the energy required for the bath and that absorbed and lost by the pipes themselves will be measured.

Materials

Thermometer, 1/2 gallon empty milk carton, clock.

Performance Indicators
(Outcomes)

Demonstrate the fuel savings potential of solar energy augmentation schemes.

Procedure

1. To find the mass of water used, determine the rate of flow of hot water and measure how long the hot water is turned on. First, measure the amount of time it takes for the 1/2 gallon carton to be filled when the hot water is turned on. (Don't burn yourself.) Do this several times to obtain a good average value.

2. Divide 1/2 gallon by the measured time to determine the flow rate in gallons/second.

3. Now draw the bath water, recording the starting time and the turnoff time. Use only water from the hot water tap.

4. Subtract these two times to find the number of seconds the water was flowing. Multiply this by the flow rate to find the total amount of hot water used.

5. Measure the temperature of the hot water as it comes from the faucet. Either a Fahrenheit or Celsius thermometer will do, as long as the temperature range of the thermometer is not exceeded. (If a mercury thermometer is used and it should break, do not touch the mercury.)

6. Add sufficient cold water to the tub to bring the water to a comfortable temperature.

7. After the cold water has been running, measure its temperature as it comes out of the faucet. This is close to the temperature of the cold water entering the hot water heater.

8. Now enjoy the bath. While you are doing so, why not determine its temperature?

9. The difference between the hot and cold water temperature is the ΔT used to compute the amount of heat required. The thermostat setting of the heater would be somewhat greater than this since some heat is lost from the pipes. The specific heat(s) for water is 1.0 cal/g C° or 1.0 BTU/lb F°.

10. To find the mass of the hot water pipe, measure its length from the tub spout to where it emerges from the heater. It will be necessary to approximate the lengths of some of the segments of pipe that are enclosed in the wall or floor, while actually measuring the length of the exposed sections.

11. If it is 1/2" copper pipe, assume it has a mass/length of 0.34 lbs/ft. If 3/4" galvanized pipe, assume it has a mass/length of 1.1 lbs/ft. Multiply the length of pipe by the approximate value to determine the mass of your hot water pipe. To convert this to grams, use 1 lb = 454 g.

12. Find the mass (m) of water left in the pipe from density $(D) = \frac{m}{v}$ or m = D x V. The volume of water equals the area of the cross section of the pipe ($A = \pi d$) times the length of pipe (use the inside diameter). The density of water is 62.4 lbs/ft^3 or 1.0 g/cm^3.

Computations

1. Galvanized pipe has a specific heat of 0.11 cal/g.C° or 0.11 BTU/lb.F° while copper pipe has a specific heat of 0.09 cal/g C° or 0.09 BTU/lb.F°. The pipe will have increased its temperature from about room temperature to the same temperature as the hot water. From the data collected, compute the total heat required for the bath from: total heat used = heat absorbed by the water in the tub + heat absorbed by the pipe + heat absorbed by water remaining in the pipe.

$$\Delta H = m \times s \times \Delta T \text{ (bath water)} + m \times s \times \Delta T \text{ (pipe)} + m \times s \times \Delta T \text{ (water in pipe)}$$

This computation does not include the heat lost from the pipes to the surrounding air and walls while the water is running.

2. If the determinations were done in the English system, convert the total heat used in BTU's to calories using 1 BTU = 252 calories.

3. Assuming that 1.0 calories = 1.16×10^{-6} kw hr of energy, compute the cost of the hot water if electricity was used and costs 3¢ per kw hr.

Procedures

Performance Indicators
(Outcomes)

4. What is the amount of energy required from fossil fuel that was used in generating the electricity if your family has a hot water heater (assume 33% efficiency for a fossil fuel generating plant)?

5. Assuming a solar collector of 2' x 4' at 30% efficiency is receiving energy from the sun at a rate of 1 cal/cm^2 x minute (929 cal/ft^2 x min), how long would it take this solar collector to produce this hot water?

9.] Develop with the class a list of all sources of energy, including those which are presently considered somewhat "exotic." Assign readings from the bibliography which begins below, and instruct students to collect the data necessary to complete a chart similar to the one below.

List and evaluate alternative energy sources.

Source of Energy	% of tot. energy used - 1977	% of tot. energy used - 2000	Remarks

Discuss the feasibility of such energy alternatives as geothermal, wind, solar, hydrogen, gasified coal, etc. The Remarks column in the chart above should be the springboard for such discussion. (See note on page 66.)

Resources

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Wert, Jonathan. *Selected Resource Materials for Developing Energy Education/Conservation Programs*. Washington: National Wildlife Federation. [1.]

Zener, Clarence. "Solar Sea Power," *Physics Today*, vol. 26, no. 1, 1973, p. 48.

Numerous additional procedures which will round out this science-oriented Part I of Unit 5: Energy may be found in the Department publication, *Living Within Our Means: Energy and Scarcity, 7-12*, as follows:

Activity 1, p. 36
Activity 1, pp. 56-57
Activities 4-8, pp. 59-62

Procedures

PART II

1.] Members of the class should explore the nature and uses of energy in the following ways:

- Discuss the definitions of the types of energy as elicited by Procedure 1 in Part I of this Unit (p. 56).
- Develop a descriptive, very specific case study of the source/production and consumption of energy by the constituents (plant or animal) of a given, carefully circumscribed ecosystem (e.g., forest, pond, marshland, seashore, etc.).
- Develop another case study detailing the production and use of energy by humans in some component of society (e.g., community, State, or region).
    - Describe and compare the relative efficiencies of the two processes studied above.
    - In which system is a greater "price" paid for energy? Explain fully.
- Have a few students describe and demonstrate energy by means of performing for the rest of the class the experiments which comprise Procedures 1 and 2 in Part I of this Unit.

2.] Students should develop a list of all the sources of energy (nuclear, petroleum, coal, solar, geothermal, etc. which are presently used to some degree or other, giving examples of their uses. The data might be presented in the form of a table with a "Remarks" column containing comments on practicality, efficiency, availability, state of the related technology, etc.

The class should construct a pie chart showing the extent in percentages to which each of these sources contributes to our current energy requirements. Students should then write summary appraisals comparing this reliance on these sources with the qualifications regarding availability, limitations, and supply as reported in the first part of the procedure. (It will become obvious that our dependence upon petroleum should be carefully reexamined in light of the limited, finite nature of the resource.)

Performance Indicators (Outcomes)

Describe the types of energy.

Develop an energy profile of an ecosystem.

Compare plant and animal uses and demands for energy with those of humans.

Describe all of the energy sources presently used and show the extent to which they are used.

Procedures

Performance Indicators (Outcomes)

- Did the energy crisis of 1973-1974 prove beneficial in terms of its value as a warning that our energy consumption practices are dangerously profligate? Consider the 1976-1977 nautral gas shortage.
- Has the crisis been largely forgotten with the disappearance of long lines at the pumps? Discuss.

Review public opinion poll results as a means of assessing popular trends.

3.] Select excerpts from *The Limits to Growth* for the students to read. Have them characterize the tone of the message about finite resources therein.

- Were you impressed with the arguments and the statistics, or the modeling device used? Explain.
- Does the general argument make you an advocate? Why or why not?
- Find out what the "Club of Rome" is.
- What are the implications of its recent, adjusted position statement (1976) in terms of the above, and generally?
- What does it mean to recant? Is their new position a recantation?
- Explain the following statement: "The pessimistic forecasts made by the Club of Rome have a tendency to become self-fulfilling prophecies." Is the statement a fair description of the positions taken by this group? Why or why not?

Using the Ford Foundation Report, *A Time to Choose*, ask students to read the first chapter and the first few pages of chapters 2, 3, and 4 as background for understanding the strategy of constructing scenarios of energy futures.

Have the class develop its own simplified scenarios, possibly reducing the scope of the problem from worldwide to national dimensions (although the international aspects of supply cannot be ignored when doing so).

Predict future situations on the basis of present information.

- Are any of these projections truly believable? Explain.

Procedures	Performance Indicators (Outcomes)
• Will the general public accept the fact that at least one of these eventualities must be realized? • What can be done to get the public at large to accept the importance of such cerebrations?	
Elicit from the student some specific, imaginative ways in which such scenarios, their substance, and their importance may be presented to the public via the "entertainment" and news media.	Examine personal energy consumption habits.
4.] Instruct each student to maintain a daily energy log by listing the electrical appliances and devices in use each day and the duration of use. They should do this over a period of one to two weeks in order to develop a credible daily average, multiplying the average by 365, and comparing these figures with the annual estimates provided in the chart found on p. 208 of the Appendix. For example: A toaster is used 5 minutes daily x 365 days = 1825 minutes ÷ 60 minutes (per hour) = 30 hours annually (approx.) x 1200 watts (wattage of the toaster) = 36,000 watt hours ÷ 1000 (watts per kw) = 36 kilowatt hours x $.03 per kwh = $1.08 annual cost	Examine personal energy consumption habits.
Discuss with the class the modifications we have already experienced in our lifestyle due to the energy crisis, and suggest the possibility that we will have to increase these cutbacks before suitable alternatives are found for generating electrical energy. Consider how we might alter personal habits and conserve electrical energy. Suggest ways we may make a conscious effort to save electricity. Calculate the wattage saved by some of the suggested conservation practices. Be practical and realistic and aim for a lifestyle that could be readily and comfortably maintained. • Which appliances consume the most energy? • Is this so because they are high wattage appliances or because they are used for greater lengths of time? Do some consume more energy for both of these reasons? Explain, giving examples.	Propose alterations and modifications in lifestyle which will reduce energy consumption.

Procedures

- Which appliance was associated with the greatest neglect of turning off when not in use? Give possible reasons.
- What can be done, or is being done, to encourage the manufacture and marketing of longer-lasting and more energy-efficient appliances?
- What role can the consumer play in speeding up this process?
- How do utility companies handle shortages during peak consumption periods, such as hot spells when air conditioners are used extensively?
- What does it mean when "power" companies announce they are cutting back the voltage by 3 percent or 5 percent?
- Will we ever again have enough energy to be able to (ab)use it as we have done in the recent past? Explain.

5.] The United States presently finds itself in an energy and resources bind. Oil production and imports have risen somewhat, temporarily alleviating the crisis, but energy resources and other nonrenewable natural resources will become scarcer in years to come. There is considerable debate as to whether such a situation might have been better anticipated than it was. Have each student make one selection from the following list of developments which occurred over the past quarter of a century, but which have only recently gained the attention they merited. While reporting findings, they should speculate as to what factors caused these developments to go unheeded.

1952 - President's Materials Policy Commission (Paley Report)
... warned of the exponential increase in energy resource use
1954 - Bureau of Mines decision to curtail research into coal conversion (to oil and natural gas)
... the premise that Germany had such technology, and other factors inveighed against this and other types of energy research
1954 - Phillips Petroleum Ruling of the Supreme Court
... giving the Federal Power Commission the authority to regulate natural gas prices low, thus discouraging exploration for, and development of, new supplies

Performance Indicators
(Outcomes)

List consumer action strategies which would alter appliance production objectives.

Procedures

Performance Indicators (Outcomes)

1963 - Decision to build more than 40,000 miles of interstate highways ... the effects of this decision upon resource use (automobile production) and energy use (gasoline consumption) are almost incalculable

1966 - Annual Report of the Atlantic Richfield Company ... outlined the prospects for a domestic energy gap

1970 - information that United States oil production was peaking ... coupled with continued increases in consumption and the problems of relying heavily on imports, a crisis became inevitable

Continue discussion of these problems beyond the student presentations through questions such as those below.

- What will be the effect of the Clean Air Act requirement that utilities convert from the use of coal to oil for generating energy? What changes in this requirement are beginning to emerge already?
- What has been the history of the Alaskan pipeline controversy and what will be the impact on the fuel supply problem of this source of petroleum?
- What are environmental impact statements? Give examples.
- Do they contribute to the bases for sound policy and decisionmaking? Why?
- What changes in legislation, executive policy, and public attitudes will be necessary to make these impact statements more effective instruments of environmental protection?

Summarize the significant elements (and opposing views) of the Alaskan pipeline controversy.

6.] Recent history shows a steady growth in transportation energy use at a rate more than double the population growth rate. Between 1950 and 1970, transportation energy consumption increased by 155 percent as a result of a 124 percent increase in traffic and a 14 percent increase in overall energy intensiveness. The latter increase was due to increases in energy intensiveness for individual modes and the shift from buses and trains to airplanes. For the same time period, energy consumption for urban passenger traffic grew by 165 percent, as traffic increased by 132 percent and energy intensiveness by 14 percent.

Procedures

The energy intensiveness of a transportation mode—the relative amounts of energy needed to move passengers or freight—is an important consideration in an analysis of the impact of transportation on the energy crisis. Pipelines and waterways are the most energy-efficient modes, followed by railroads and trucks. The airplane is the least efficient mode. Discuss the charts on the next page.

- What does this pie chart tell us about the importance of transportation for the energy crisis?
- When the Administration requested Americans to lower the temperature in their homes and reduce their driving speed, was it attacking the real problems of energy misuse? Explain.
- Predict the effects the following would have on transportation and on the energy crisis:
  - increasing the oil depletion allowance
  - increased federal oil leasing
  - limiting oil imports
  - imposing governmental pollution controls
  - raising oil prices. (This reduces the demand for oil. Reduced demand is likely to result in a shift toward low energy intensive transportation systems.)

7.] Instruct the students to use the information provided in the chart on page 74 and construct a table which gives this information for periods other than the present at intervals (e.g., 20 yr , 25 yr) throughout American history. If they have difficulty finding this using standard historical references, they should check listings under the specific subject heading of "energy." Other sources would be the Energy Research and Development Administration and the Federal Energy Administration in Washington, D.C.

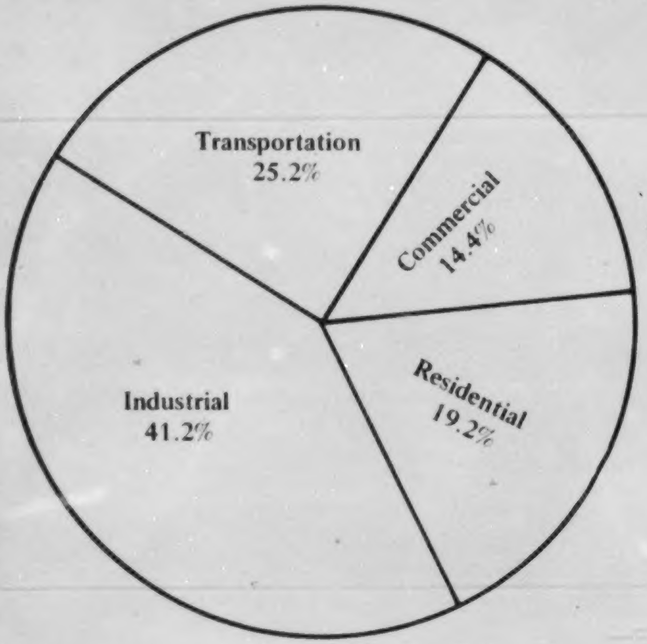
Once the information is recorded, the students should prepare a display-size line or bar graph depicting the information. Through class discussion, develop a rationale or set of reasons for the emergence, disappearance, rise, fall, or stasis of each source of energy.

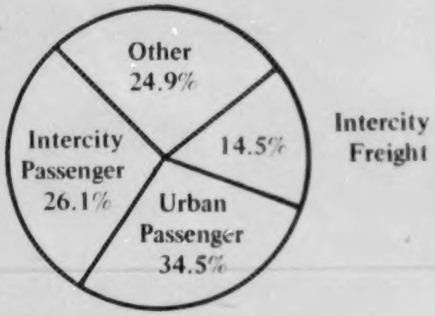
Performance Indicators (Outcomes)

Explain energy intensiveness in terms of passenger or freight transportation.

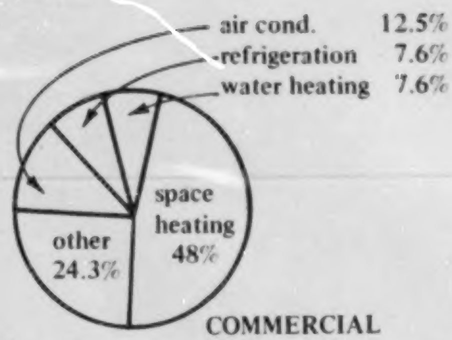
Chart the growth of energy use throughout American history.

HOW DOES THE U.S. USE ITS ENERGY ?

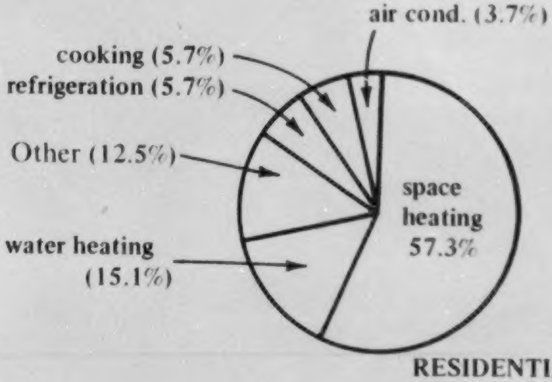




TRANSPORTATION



COMMERCIAL



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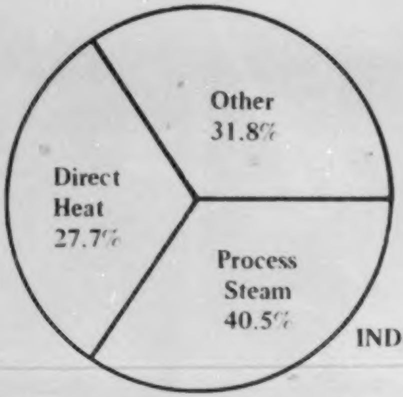
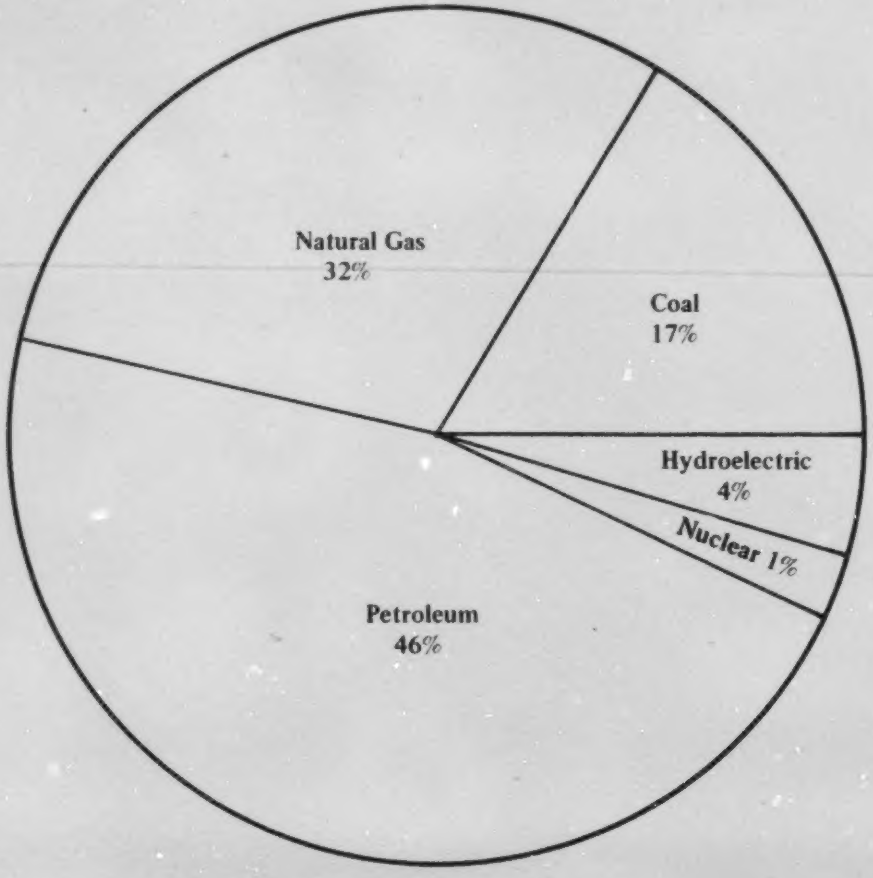


INDUSTRIAL

Source: Participants Handbook - Citizens Workshops of the U.S. Atomic Energy Commission

Present Sources of Energy*



*United States, 1972

Source: Handbook for Citizens Workshop on Energy and Environment (1973-74, USEAC)

Procedures	Performance Indicators (Outcomes)
8.] Consider in greater detail, and on a more personal basis, the problem of dwindling oil supplies. If the United State is to use less petroleum and be less dependent upon other countries for what is used, we must find acceptable ways to conserve the fuel. Many people have proposed that the tax on gasoline be increased by 10, 20, or 25 cents. Conduct a survey among class members to ascertain their reactions to questions similar to the following: • Would you favor this new tax? Explain. • How would such a tax (consider each amount; 10, 20, or 25 cents) affect your gasoline purchases? • What would it take to make you buy less gasoline?	Personalize the conservation experience through an examination of one's own views about gasoline use.
9.] Share the headlines below with the class. Ask each student to select several and to write a brief (one paragraph) article which would explain the headline. Select others from the news media in order to afford a wider choice.	Report on energy developments and information in a concise, useful, journalistic manner.

GM Lays Off Thousands of Workers

Ammonia-powered Car Built by Students

Clean Air Bill Defeated by Legislature

Americans Turn Down the Thermostat

Steam Bus Cuts Smog

Natural Gas Prices Increase

Conservationists Fear Effects of Nuclear Power Plant

Procedures

10.] The proliferation and growth of Federal agencies in the executive branch of our government is a 20th century phenomenon, unparalleled in the nation's history. Several having to do with environmental matters have been created in recent years including the Environmental Protection Agency (EPA), the Federal Energy Commission (FEA), and the Energy Research and Development Administration (ERDA).

Have each student prepare a report on the activities, policies, and mandates of the Federal Energy Administration, developing the report in light of the following considerations:

- When was the agency formed and why?
- What was (is) its avowed purpose?
- How effective has the Agency been in terms of achieving its objectives?
- Secure a copy of its newsletter, The Energy Reporter. Evaluate this publication.
- Was the FEA established as an independent agency or was this an "executive action"? Explain.
- How (by what authority) are such agencies established?
- Do their functions parallel or overlap those of the cabinet departments? Explain.
- How "independent" are these agencies? What is their relationship to the President and the Executive Office and to Congress?
- Predict the future of such agencies given the constant reshaping of Federal-state governmental relationships.
- Does the fact that state governments have similar agencies result in any conflict of responsibilities between the Federal government and the state governments? If so, where and how do these conflicts arise? How are they resolved?

Performance Indicators (Outcomes)

Describe the objectives and activities of the FEA.

Explain the status authority of executive agencies such as FEA and ERDA.

Procedures	Performance Indicators (Outcomes)
• Develop a case for whether or not such agencies and offices can resolve such pressing issues as environmental protection, resource use, and energy conservation. Give examples of recent activity of this type by FEA and EPA.	
• Use the recent examples of energy legislation in Congress to describe the kind of cooperation among the branches of government that is necessary to resolve the nation's problems.	Summarize recent energy-related legislation at the Federal level.

- Cite examples of how pressure groups, private interests, and various lobbyists seemingly are able to thwart policies and legislation which might promote the nation's general welfare by successfully representing special interests.
- Compile a list of these groups and organizations which seem to "work the other side of the street."
- Is there room in our form of government for what might be called "citizen's lobbies?" Explain. Name an example of such a group which is presently active.
- Summarize, with specific press references, both the optimism and the pessimism expressed in terms of coping with our energy and resources situation. Which types of comments are justified.

Now, ask the students to develop a similar report on ERDA, using the same considerations as those for FEA adding only:

- Summarize briefly the history of the Atomic Energy Commission (AEC). What is its present status?

ERDA proposes as its five goals:

1. To maintain the security and independence of the nation;
2. To maintain a strong and healthy economy, providing adequate employment opportunities and allowing the fulfillment of economic aspirations (especially in the less affluent parts of the population);

3. To provide for future needs so that lifestyles remain a matter of choice and are not limited by the unavailability of energy;

4. To contribute to world stability through cooperative international efforts in the energy sphere;

5. To protect and improve the nation's environmental quality by assuring that the preservation of land, water, and air resources is given high priority.

In a reprint from *The Science Teacher*, Volume 43, Number 3, March, 1976, John Fowler's article "Energy, Education, and the World Criers" suggests the following in relation to the goals of ERDA:

> "These goals are general enough that we must look past them to their implementation to determine their operational meaning. Even as they stand, however, we can see in them the germs of conflict. The first and fourth ones, for instance, remind us of the difficulty of balancing one nation's energy desires against world needs. The second and fifth goals involve two presently conflicting priorities. There is much to be gained from vigorous classroom discussion of the give and take which will be necessary to create a satisfactory operating plan from such goals."

As Mr. Fowler suggests, discuss with the class the paradoxical or problematical nature of these seemingly conflicting goals and have each student summarize this discussion by writing the answers to the following questions.

Understand the conflict inherent in energy-economic-environmental goals.

- Could you revise these goals to eliminate the conflicts? How?

- If you could, what would be the "trade-offs?"

11.] Conservation will always be a significant deterrent to profligate energy consumption. In the absence of governmental leadership in the area of energy conservation, individual initiative and community cooperation must play a strong role.

Procedures

Ask each student to develop a comprehensive checklist of personal, domestic, and community-wide conservation procedures and activities. Each may devise a personal checklist using suggestions which have appeared in the media, in utilities brochures, and in government publications. Once the checklist is complete, possibly after the fashion illustrated below, reproduce it in sufficient quantity to distribute it in the school and in the community.

With the distribution, either of these two approaches might be used:

- Pass out the checklists as suggestions to be followed and personally accounted for by the recipient.
- Use the checklist as a survey of what is being done and of what can be done. In this instance, each recipient might be provided with two copies; one to return for survey purposes and one to retain as a personal suggestion and checklist.

am doing/can do	might do	can't do/won't do	
			Heating and Cooling set thermostats at 68° daytime, 65° nighttime close fireplace damper when not in use use extra blankets etc...
			Transportation reduce driving speed use and encourage mass transit keep engine idling at a minimum etc...

Performance Indicators (Outcomes)

List effective energy conservation measures.

Survey peers, family, and community with regard to their willingness to conserve.

Procedures

Performance Indicators
(Outcomes)

am doing/can do	might do	can't do/won't do	
			Utilities reduce amount of bath and shower water used wash only full loads in dishwasher and washing machine reduce bulb wattage where practical etc...

- Describe the measures, collective action, referenda, etc., which you feel will be necessary to prompt government to take strong energy conservation steps?

Propose the actions which must be taken by government to reduce energy consumption.

- Discuss some of the factors which have thus far worked against this worthwhile goal.

- How did other students, your parents, and community residents react to the survey and informational tasks you had given yourselves?

- Were the recipients of the forms cooperative and prompt in replying?

- Speculate as to the reasons for their behavior in this regard.

12.] Buildings use one-third of all the energy consumed in this country. It has been conservatively estimated that 40 percent of this energy is wasted. In view of that information, consider the following statement:

Describe how energy conservation may be accomplished in new building construction.

"Energy is Your Architect... It Shapes the Building."

- Explain the statement and give some specific examples which illustrate what you think it means.

Procedures

Performance Indicators
(Outcomes)

That statement may be found in an article in the periodical, Nation's Schools. (See p. 83.)

Ask the class to read and summarize for discussion the suggestions in the article designed to implement the recommendation implied by the title.

Students should then compare their school building to the ideals for buildings represented by these suggestions. A categorical, comparative checklist would be an efficient way to do this.

- Even though your school building might not compare favorably with the ideal, can you find some recommendations which can be incorporated into the building as it stands?

Suggest ways of conserving energy in existing buildings.

Numerous additional activities to supplement the foregoing procedures in Part II of Unit 5 may be found in the Department publication, Living Within Our Means: Energy and Scarcity, 7-12, some of which are indicated below:

Activity 2, p. 7
Activity 4, pp. 9-10
Activity 2, pp. 77-78
Activity 3, pp. 90-91
Activity 5, p. 91
Activity 9, p. 94

See also the Unit, "Fruits of Wisdom," in the Department publication, Materials For Using American Issues Forum in the American History Classroom, Topic IX; Life, Liberty and the Pursuit of Happiness.

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PLEASE DO NOT RAP ON THE WINDOW.

UNIT 6: LAND USE AND MANAGEMENT*

Background

A resource which appeared to our founding fathers to be limitless is now threatened by population expansion, by the needs technology generates, and by our rapacious appetite for fossil fuels. This resource, the land which sustains us, is being covered over with housing developments, industrial complexes, and highways at the rate of over a million acres annually. Equally distressing is the fact that our increasingly urban society has developed an insulation from the land thereby diminishing our respect for it. At the same time, this concentration of more than 80 percent of the population in cities which occupy only one percent of the land places enormous stresses upon unoccupied land, since the urban areas are not self-sustaining.

It is time for a policy of land use which recognizes the role in terms of world food supply that this nation is being called upon to fulfill. When only 12 percent of the world's surface is arable, population policy becomes as important as foreign policy for many nations. Further, in highly industrialized countries, the use of land as a recreational resource becomes increasingly significant as the demands and stresses of society become more complex.

A renewed respect for land as a resource; recognition of its limited renewability; and, incorporation of a land ethic into a general conservation ethic are imperatives which apply to all.

General Understandings:

- International cooperation in the techniques of land management will be necessary in order to fully utilize the land resource as a means of mitigating population pressures, resource depletion, and the problems of food supply.
- Social, economic, and technological changes affect the quality, availability, and use of the land resource.
- The land, soil, trees, and water are classified as renewable resources but, because their renewal or revitalization requires a major investment in time and effort, they may be more realistically considered depletable resources.
- A study of the historical growth of cities mirrors the manner in which land has been used and misused and reflects the values and priorities inherent in these practices.
- The application of sound planning and management techniques to land use is essential to the effective utilization of that multiple use resource.

Procedures	Performance Indicators (Outcomes)
1.] Have each member of the class obtain information on how land is used in two developed nations (excluding the United States) and in two developing	Use reference tools to gather land use data.

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*Consider using the Department publication, American Issues Forum, Topic II: The Land of Plenty as a supplement, or resource for this unit.

Procedures	Performance Indicators (Outcomes)
nations; e.g., percentages of total acreage used for forests, cropland, grazing, recreational purposes, cities, and other purposes. Represent the data on a circle graph for each of the four nations. Students should then add to their reports the information asked for below.	Represent this data as percentages of a whole in graph form.
-Compare this information with the same type of data for the United States. -Describe any specific land use policies being effected by these nations which will tend to alter any of these figures. • Will the changes be immediate or long-range? Explain.	Identify cultural, social, and economic factors which cause differences in land use practices in different nations.
-Research current Federal government agencies' policies which govern the use of land.	
• How will land use patterns in the United States be changing in the next decade, given present trends and policies?	Predict future changes in the way land will be used based upon geographic, demographic, and economic data.
• Does a conservation ethic exist in this country, to the extent that sound land use planning and management will occur? Explain.	
• How can privately owned land be managed in the public interest? Should it be?	Verbalize an understanding of the word "ethic." Demonstrate its application to the concept of conservation by developing a brief, personal conservation ethic statement.
2.] Students should develop a list of geographical factors which influenced the location of early American settlements, and the lifestyles and occupations of settlers in early American history, giving specific regions and areas whose development reflects these factors (e.g., New York City and Hudson River Valley settlements).	Relate geographic characteristics (e.g., river valley) to reasons for settlement (e.g., fertile farmland).
• Do today's population density figures continue to evidence these early settlement patterns? Explain with specifics.	

Procedures	Performance Indicators (Outcomes)
• Contrast the use made of the land by pre-Columbian Native Americans with the land use practices of early European settlers in America. • Did Native Americans exhibit a lifestyle that was compatible with their environment? Explain.	Give a brief synopsis of a reading which describes the relationship of pre-Columbian Native Americans to their environment.
Using the periods 1790-1860, 1865-1930, and 1945-1970 in our Nation's history, have each student list ten major technological advances or discoveries in each, and describe the direct or indirect impact these advances or inventions had upon the way the land was used (e.g., automobile → highway construction......).	Select and organize chronologically items related to specific historical sub-topics.
3.] Ask for reports on the history and vital statistics of a sprawling metropolis which is an example of topsy-turvy, unplanned growth. Using a graph and a narrative, students will contrast this information with that which can be learned about cities such as Brasilia (Brazil), Reston (VA), Columbia (MD), or any other "new towns" that you are aware of. • What are the apparent advantages and disadvantages of both planned and unplanned urban areas? • In which area would you choose to live and why?	Examine and chart (graph) demographic data dealing with urban trends.
Have a committee develop a report on the issue question of whether or not communities may take the next step beyond zoning (planning and shaping their own characteristics), that of limiting or excluding population growth which results from in-migration (exercising selection over the characters who may live there). A recent court fight concerning the community of Petaluma, California centered on this very issue. (See p. 210 in the Appendix for references to the case in Petaluma.) • If you lived in a location that was judged extremely desirable by significant numbers of people, many of whom were potential migrants to your locality, would you wish to be able to decide how many people should share your contentment? Explain, citing a real or hypothetical locality, its attractions, and your reasons for either sharing or maintaining exclusivity.	Postulate positions and alternatives based upon accumulated data and evidence.

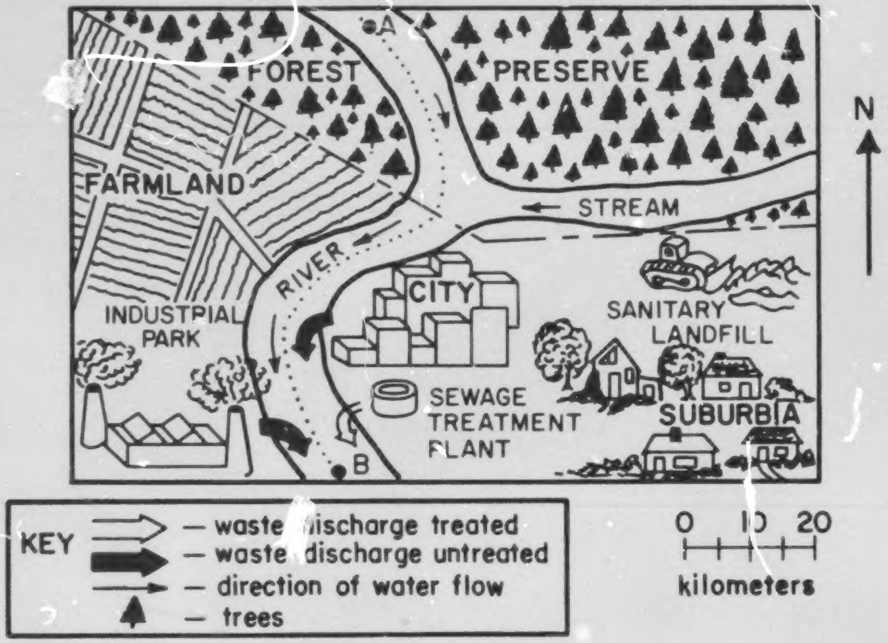
Procedures	Performance Indicators (Outcomes)
4.] As a class project, with individual tasks assigned to members of the class or groups of students, develop a comprehensive land use and zoning study of the local community. Use maps with overlays, charts, graphs, and photos to illustrate the following major parts of the study:	Prepare maps and overlays depicting land use alternatives.
-historical growth (population and area) of the community from its founding to the present	
-the present zoning characteristics of the community (residential, agricultural, commercial, etc.)	
-a projection of what land may still be developed or redeveloped	
-an analysis of how the land is used (graph representations of percentages for housing, business, industry, recreation, highways and streets, public services [sewage treatment, landfill, power stations, etc.], and farming [types])	
-estimates of how much industry, business, housing, and recreation may expand, and at the expense of what	Balance the dollar costs and benefits of urban development with the less tangible costs of precluded amenities, depleted resources, and absence of aesthetic considerations.
-a narrative analysis of how much and what kinds of growth may yet feasibly occur within the community	
-as a summary, a mockup of a brochure describing the community and its characteristics and its attributes	

Procedures

Performance Indicators
(Outcomes)

5.] Good land use planning is an important aspect of environmental conservation and improvement. Conduct a class discussion on planning practices with the aid of the map and questions given below.

Depict examples of sound land use with plot plans and area maps.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— waste discharge untreated
— direction of water flow
— trees
0 10 20
kilometers

- Which landscape region has probably been altered least by human activities? Explain.
- Describe the likely rates of surface water runoff during a 1-hour light rain on the four areas (forest preserve, suburban, city, and farmland) by arranging them in order from most to least runoff. Explain.

Explain the significance of surface water runoff.

Procedures	Performance Indicators (Outcomes)
• What effect would a second industrial park have upon the environment?	
• Should people living here support legislation to rezone this land to allow for a second industrial park? Why or why not? Give some advantages and disadvantages.	
• Does the map represent a well-planned area? Explain. What changes could be made to improve the area's environmental quality?	
6.] Over a short period of time, students should compile a collection of news items which deal with issues of land use (e.g., the construction of apartments; a new road; urban redevelopment, etc.). Discuss these specific incidents in class, weighing or ranking them in order of significance according to: size of the land area involved; impact on population; short- and long-range consideration of public services, etc.	Survey and analyze media treatment of land use issues.
Class members should assume the roles of interested parties in the dispute or issue (real estate agent, land developer, banker, average citizen, tax collector, mayor, Chamber of Commerce president, environmentalist, fire chief, etc.) dramatize the vested interests involved, and try to settle the issue for the sake of the greatest number of people. An outcome could be a master plan for land use.	Investigate, develop, and play the roles of the types of individuals who would be interested parties and adversaries in a land use issue.
• What elements of such a plan would be adaptable for Statewide or national use?	Identify opportunities open to citizens to participate in land use decisionmaking.
7.] Class members should conduct a study of the organization and functions of Federal, State, and municipal government agencies to determine wherein lies responsibility for land use planning and management. Charts showing these organizational structures in terms of their relationship to executive decision-making and public policy would be included.	Identify specific governmental agency responsibility for land use planning and management.
• Explain how popular opinion and private interest group pressure can or does affect such matters.	

Procedures

Performance Indicators (Outcomes)

- What are the names of these governmental agencies and their specific, land-use-related functions?

- What has been the role of private, not-for-profit organizations (Sierra Club, Nature Conservancy, etc.) with respect to land use planning and management in recent years?

  Note: This question may be omitted if Procedure 9 is used.

8.] Have the class consider the trend toward urbanization in the United States, especially during this century. Using base maps of the country, students should develop a key indicating the changes in population density by regions for 25- or 50-year intervals. It would also be useful for them to graph the rises in population in major United States cities since 1776 (top ten or twenty for each time interval).

Graph and analyze population statistics in terms of the meaning of changes and trends.

- Define and discuss the concept of megalopolis.

Locate existing and potential megalopolises.

- What is the social and economic fallout or upshot of this urbanizing trend?

- Must the trend be encouraged or halted? Why?

- Explain what the options are for present residents of cities. What are their problems? Do the solutions rest with the people themselves, the city, or with the Federal government?

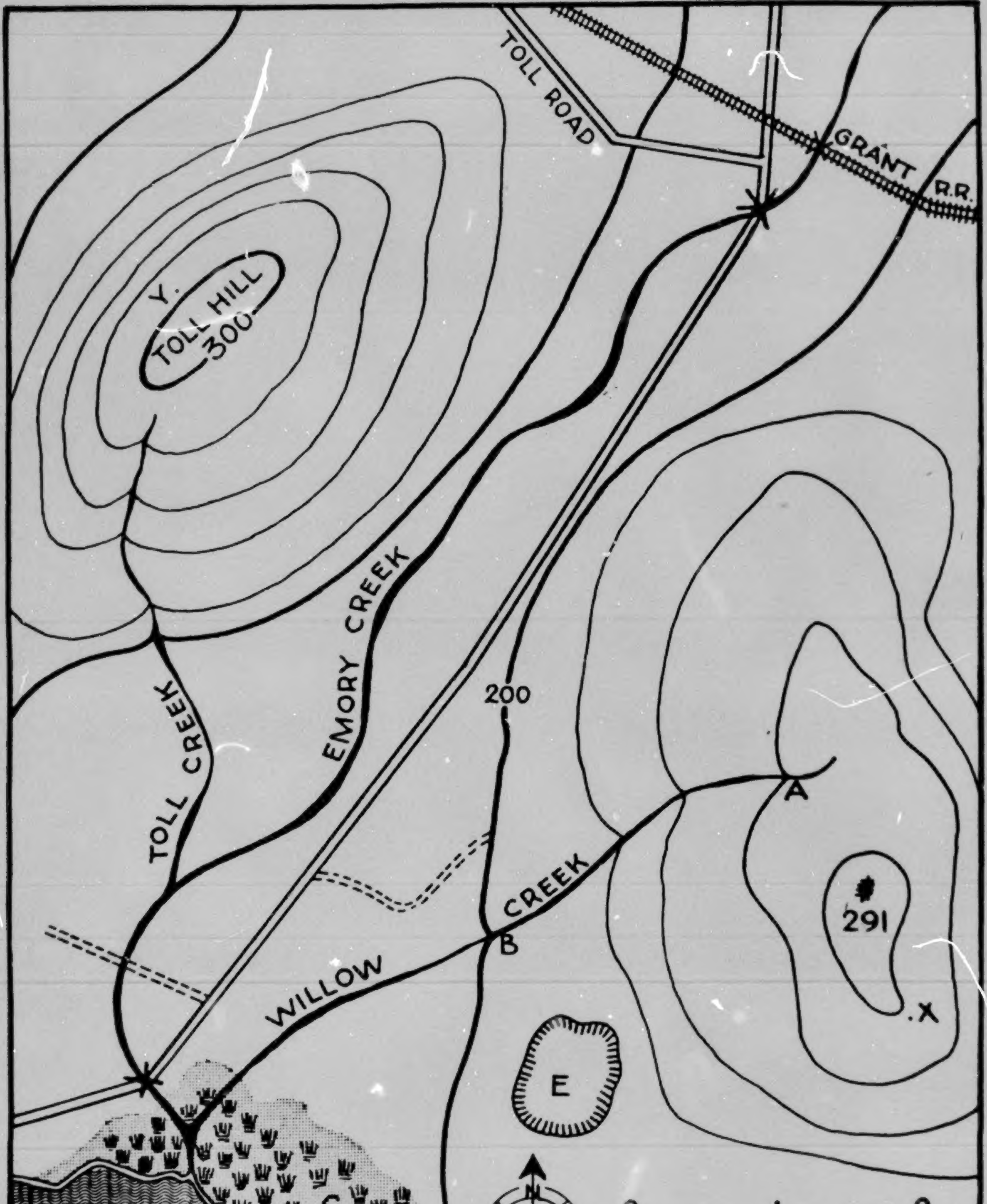
- Debate these statements:

  A large population such as ours (will, might) not be able to live at its present standard of consumption without high concentrations of people and economic activity.

  If it is desirable to slow or stop the growth of very large metropolitan areas, it would be very difficult to do this without slowing the growth of the whole population.

- Study aerial photographs of a metropolitan area. Why are some areas apparently unused despite the overall population density? What are these areas?

Procedures	Performance Indicators (Outcomes)
9.] Assign reports on the history, structure, objectives, and successes (or failures) of a land use management or preservation organization such as the Adirondack Park Agency, the Nature Conservancy, Friends of Earth, Sierra Club, and the National Audubon Society. • What has been the impact of these organizations upon land use, planning, and preservation? • Should such organizations (the private, not-for-profit ones) be publicly supported (with funds)? Why or why not?	Understand the nature of public and private not-for-profit advocacy organizations.
10.] Students should outline and explain the significant legislation in United States history which has affected the use of our land. (Land Ordinances of 1785 and 1787; Merrill Land Grant Act of 1862; Housing and Urban Development Act of 1970 [Pl 91-609].) • List any other land-use-related legislation. • Do these legislative acts reflect a national commitment to wise use of the land? Explain. • Are any of them comprehensive enough to address the multifaceted issue of land use as it has been discussed thus far in the unit? Defend your answer.	Relate historical land use milestones to the prevailing philosophy of land use. Cite legislative references as supporting data.
11.] The tract of land illustrated on the accompanying map (next page) represents a rural area given to the town of Hillcrest, New York by a family who, for generations, owned the land. Several specific conditions were stipulated in the agreement. • No more than 20 percent of the land might be sold by the town for single family residences. • No more than 20 percent of the land might be sold by the town for commercial establishments. • No more than 10 percent of the land might be sold by the town for apartments and condominiums (each building shall consist of no more than eight units.)	Glean pertinent data from simple base maps.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SCALE OF MILES

Procedures

- No more than 15 percent of the land might be used for commercial recreational areas.
- The remaining 35 percent of the land must be maintained and kept as "forever green" areas.
- The former owners further directed that the town board appoint a committee of nine local residents to serve on an advisory committee to develop plans for implementing their conditions.

Instruct nine members of the class to serve as members of the advisory committee. The committee should develop plans and ordinances to implement the agreement. Some preliminary calculations should be made before planning begins.

- How many square miles are there in this tract of land? How many square kilometers?
- How many acres are there in the tract of land?
- What is the contour interval?
- Where is there a steep slope? ...a gentle slope?
- Where is the area level?
- What is the elevation of the highest point? the lowest point?
- Where is the location of a hilltop? ...a depression? ...a swamp?
- What is the depth of the depression?
- How do countour lines indicate streamflow?
- How are directions indicated?
- What is the gradient of each of the streams?
- Construct several profiles through various areas of the region.

Performance Indicators
(Outcomes)

Develop ordinances which will effectuate or execute agreed upon conditions of land use.

Acquire an understanding of land measurement and topography sufficient to permit characterization of land parcels.

Procedures	Performance Indicators (Outcomes)
Invite a member of the town board planning staff to the class to discuss the various priorities, zoning laws, and problems related to land development in response to a list of questions carefully developed in advance. Of particular interest will be the planner's explanation of land use priorities.	Establish contact with local government officials in order to satisfy specific informational needs.
Have the class develop maps of proposed, alternative land uses for the tract which can be made into overlays for overhead projection and discussion.	Use transparencies with coordinated sets of overlays to create base map series.
The suggestions, compromises, and trade-offs which result from this discussion should be prepared as a report to be submitted to the student "advisory committee." The committee would then either act upon the plans or suggest amendments while returning the plans to the class. (This step must be repeated several times.)	
Assign responsibility for preparing a complete, written report of the experience.	Prepare succinct summary reports of investigative experiences with land use planning and management.

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UNIT 7: TRANSPORTATION

Background

"I think the evidence is overwhelming that mass transit is the direction to go if we expect to make any headway against the sickness of the cities." (John Volpe, former Secretary of Transportation)

"Our excessive reliance on the automobile makes the creation of better, finer, and more liveable cities impossible." (John Volpe)

"If a worker has to get up at 5:00 a.m., spend two hours transferring among three or four different bus routes, and pay $2 for the privilege of getting to work, he or she is rather likely to stay in bed and sneer at job opportunities." (Anon.)

Transportation and the environment raise a spate of challenges which are both technical and conceptual. Social rethinking, restructuring, imagination, and planning are needed if all goods and people are to continue to enjoy the mobility we have come to take for granted in this country. The development of the automobile seemed to place this added freedom within the reach of millions, but at enormous costs not realized at the time. The luxury of individual, on-demand motion, which the automobile represents, has become a "right" to be relinquished as reluctantly as any of the guaranteed rights.

Not only must the place of the automobile in American life be examined, but the other basic and alternative transportation modes should be studied. While technical solutions to the problems may not be the only ones, awareness of some of the experimental programs in transportation is essential: Hypersonic Transport; the Gravi-Train; and, the Integrated Transportation Hub, to mention a few.

Even if the automobile becomes 100% non-polluting in the near future, we will continue to lose millions of acres of land to highway and parking lot construction. Urban sprawl, traffic jams, and other social and economic costs will continue to rise. If goods and people are to move rapidly, cleanly, and safely, better and cheaper means must be found to do it. Important as technical solutions are, new yardsticks must be applied to old assumptions.

General Understandings

- Transportation costs, particularly those of the automobile, must be measured in environmental as well as economic terms.
- Transportation assumes varied and complex forms in a modern industrial society.
- Industrial and agricultural production and distribution is heavily dependent upon transportation systems.
- Inherent to mass transportation are problems that require solutions, such as capital outlay for construction and operation.
- The development of environmentally and economically acceptable systems of transportation is made difficult by individual and social value structures and economic doctrine and practices.
- Transportation technology exists which could make possible a far more effective means for moving people and goods in ways that reduce resource consumption and waste while improving the environment.

Procedures

1.] Have the class research the history of transportation in the United States and develop an information center and exhibit for use in the school building. Several committees should be selected, each having an assigned task such as to:

- collect the historical data
- design and prepare a poster or chart depicting this information
- develop a bibliography
- type and mimeograph information sheets

At this juncture, the information gathered would serve as background for the other procedures in this unit, at the conclusion of which, the information center and exhibit would be readied for opening in the foyer, study hall, resource center, or library. Committee assignments in this regard, carried out in the interim, would be to:

- plan and put together the exhibit, including transportation artifacts and realia available from the community (the possibilities are limited only by the extent of student imagination, time, and space available for the exhibit)

- prepare a press release for the purpose of publicizing this event in the school newspaper (and the local press [?])

- secure on loan films about transportation and schedule screenings of these during study periods and before and after school

- develop and administer audience survey forms using commonly asked questions about the transportation issue

2.] Beginning with data gathered in the procedure above, students should select at least two of the following problems and prepare the information or answers required by working singly or in small groups. The results or answers should be presented in written form and as an oral report to the class in order that the response to each problem be shared by all.

Performance Indicators (Outcomes)

Imaginatively represent the history of transportation.

Devise means of effectively publicizing an exhibit and its objectives.

Procedures	Performance Indicators (Outcomes)
• Compare the major forms of transportation* in terms of: -the role of the government in the development of each, including Federal and State agencies involved -mileage of systems and passengers and/or freight carried -efficiency of the system in terms of energy consumed and dollar cost to user -problems that the system either creates or solves, or both -environmental impact -future of the system -private vs. public investment or interest in each system (*auto/highway system; rail system; airlines/lanes; river/lake/canal traffic; and bus system)	Prepare a report (written and oral) analyzing the major forms of transportation.
• Explore the role of such agencies as the Metropolitan Transit Authority (New York City) and the U.S. Department of Transportation. Identify some of the most pressing issues such as subisdies for expressways vs. limitations on mass transportation funds. -How does the cost per mile of road building and maintenance compare with the cost of developing mass transit systems? -How do travel and commutation costs in European and Canadian city centers compare with those in your local area?...in the United States as a whole? -How does the cost to the individual for private transportation compare with the cost of traveling by mass transit? -List the environmental reasons for our Nation giving more serious consideration to alternatives to the automobile.	Recognize mass transit systems as an alternative to the automobile as a means of transportation. Justify this viewpoint.

Procedures	Performance Indicators (Outcomes)
-What social, cultural, and psychological factors weigh against the de-emphasis of the automobile as the predominant form of transportation?	
-Describe, in table form, the economic advantages and disadvantages of the automobile versus other forms of transportation (see p. 102).	
• Develop criteria for and then examine a local transit system in terms of how efficiently it serves the needs of those who depend upon it. Consider the mileage of the system, size and composition of the clientele, whether schedules meet the needs of the public, and flexibility of the system to provide special services on special occasions.	
• Compare Los Angeles' approach to its transportation problems (almost totally dependent upon private automobiles) with Toronto's (multi-facility mass transportation).	Recognize the forces that are working to preserve the status quo in transportation and some of the proposals for change and improvement. Name both the forces and the proposals.
-Seventy-five percent of Toronto's residents live within one-half kilometer of transportation. Might this fact be true for Los Angeles someday? Explain	
-How does your community compare with these two extremes?	
• Several metropolitan areas are experimenting with transportation alternatives such as Dial-A-Bus. Prepare a balance sheet which shows advantages and disadvantages of such a system.	Develop an economic rationale for a particular type of mass transit.
-What are some reasons for establishing a Dial-A-Bus system in your community?	
-Would such a system work in all communities? Explain.	
-How would such a system be financed? Discuss the possibilities of free service, minimal fees, and a monthly charge for unlimited use.	

Procedures	Performance Indicators (Outcomes)
• Expl[illegible] the relationship of the development of transportation in the United States to urbanization and industrialization.	Understand the role of transportation in an industrialized society and that many current problems are rooted in the past.
3.] The students should investigate and report on the status of mass transportation in their community. Insure that their results include, at least, the following types of information. -number of units (buses, trains, airplanes) in service -schedule frequency and convenience -convenience of stops or terminals -commercial or private (excluding private auto but including taxis) means of transportation which supplement or are in lieu of public -cost to the users (include local government operating subsidies) The general reporting of these results to the class as a whole should be followed by a discussion of: -the relative advantages and disadvantages of these types of transportation -the comparative efficiency of this integrated system with those in nearby communities	
-alternatives to the modes of transport the community is either "blessed with" or "stuck with."	Suggest alternatives to existing transportation modes through observation and investigation (of other communities) and creative thinking (as yet unknown forms).

Procedures

Performance Indicators
(Outcomes)

4.] Using the chart provided below, students should rate each transportation system on each of the four qualities on a scale from one to five; one for poorest performance and five for best performance. (For example, "Bicycle" could be given a five for "Environmental Impact" whereas "Car" might receive a one in the same category.) Add the scores horizontally and enter in the "Total" column. The highest total score may be considered the best system.

Rate modes of transportation on a scale to determine the best mode.

AMERICAN TRANSPORTATION SYSTEM

	Safety	Energy Efficiency	Speed & Convenience	Environmental Impact	Total
Train					
Motor Cycle					
Two Feet					
Sailboat					
Glider					
Bus					
Airplane					
Canal Barge					
Motor Boat					
Bicycle					
Car					

5.] Reproduce the reading, THE CONSUMER, THE ENVIRONMENT, AND THE AUTOMOBILE, beginning on p. 212 of the Appendix, for use as a student handout. Once this has been read by the class, discuss the following:

- Does the reading present a fair or a one-sided view of the issue? Explain.

Evaluate both sides of an issue objectively.

Procedures

Performance Indicators (Outcomes)

- While statistics are said to be unassailable, is it not possible to distort, or weight, or manipulate an issue by presenting only one type of information? Discuss.

- Try to find an editorial statement or article in an automotive journal, or automaker's annual report which extols the economic virtues of automobile manufacturing and consumer habits with regard to auto purchases. Does this give sufficient balance to the issue? Explain.

- What is your view? Or, what will your attitude be when (and if) you are in the market for an automobile?

- Do you think you could convince a 16-25 year-old that a car is unnecessary (assuming other adequate transportation is readily available)? Explain why or why not.

Summarize one's own position based upon an objective, fair appraisal of available data.

6.] The class should develop a survey and question students (16 and over) and staff members of the school as to their commuting habits (excluding the use of the school bus). A questionnaire which addresses this objective in part, but also serves other purposes, may be found on p. 214 of the Appendix. (A simpler survey related to the impact of the auto, and which may be used with younger, non-driving members of the school population, follows on p. 215 of the Appendix.)

Prepare and conduct a "community" survey.

- Can the costs related to the school district's accommodation of private autos through commuting (parking lots, traffic control, parking stickers, and landscaping for beautification, concealment, or replacement) be calculated?

- If staff and students used public transportation for commuting (again excluding the circumstance of school buses for most or all students) what would be the impact on traffic patterns around the school and community?

- What would be the advantages and disadvantages of such a shift from private to public transportation?

- If such a change were considered, how would community activities using the school site be conducted?

Procedures

7.] People should carefully distinguish between transportation needs and transportation desires when they purchase automobiles, since both economic and environmental considerations are involved. Involve the class in an automobile comparative shopping survey by way of having students learn to consider all the significant factors that such a potential expenditure represents. Have students select a luxury, a standard, an intermediate, a compact, and a subcompact from each of the four United States manufacturers, and include one manufacturer who exports to this country. Have student committees compare each model (25 in all) for base price, options, maintenance requirements, frequency of repair records, gas consumption, and resale value. The information may be obtained from dealers, consumer, and auto magazines, and the Blue Book (for resale value).

- People often buy what others want or what others want them to buy. Do you agree or disagree with that statement? Justify your answer.
- Discuss the relationship between each of the following pairs of factors involved in the purchase of an auto:

  -size and cost
  -size and gas consumption
  -options and gas consumption
  -frequency of repair and options
  -cost of maintenance and size

- Are autos, whichever type one purchases, used efficiently? Explain, considering the efficacy of car pools and improved public transportation in light of the recent oil shortage.
- Do dealers' statements on performance differ from test results as reported by consumer and trade magazines? Give details.
- What factors will be most important in helping you decide which car to buy?
- Can we continue to justify the production of 10 million autos a year? Explain.
- What environmental problems are created by the automobile? Which can be solved by diligent effort, and which may never be remedied?

Performance Indicators
(Outcomes)

Develop an awareness of the social, economic, and environmental problems attributed to the automobile.

Learn to compare exhaustively all pertinent factors when contemplating a major purchase such as an auto.

Procedures	Performance Indicators (Outcomes)
8.] Develop a family cost sheet for automobile ownership similar to the example on the next page. After completion, determine what percentage and dollar amounts of disposable family income automobile ownership requires. In addition to the costs of gasoline, oil, parts, insurance, etc., include costs for highway construction and maintenance, police, snow removal, and property and production losses because of accidents. • How important is social and economic status in the question of automobile ownership? • Why will it be difficult to persuade Americans to seek alternatives to the automobile, currently recognized as a major pollutant? • How can automobile companies be persuaded to seek ways of developing markets for automobiles which will reduce the quantity of pollution? • How can consumer values be changed to increase insistence upon a reduced number of pollutants from the automobile, or insistence upon better forms of transportation?	Develop a detailed assessment of the complete cost of automobile ownership.
9.] Ask half of the class to work collectively on a design for the automobile of the year 2000. This design should reflect consideration of all the changes society might undergo during the next 30 years. The remainder of the class would design an automobile which specifically considers the disadvantageous aspects of current automotive production in terms of our concern for the environment. Compare the foresight evidenced by the first group with the directed effort of the second. • Has the general concern about the automobile's contribution to the general environmental crisis been effectively transmitted to the first group of students? Explain. • Why have automobile manufacturers not responded more quickly with alternatives to the internal combustion engine? • What will be necessary to cause consumers to relinquish their taste for high speed autos and frequent design changes?	Convert known needs for autos of the future to design features of such an automobile.

THE COSTS OF AUTOMOBILE OWNERSHIP

Each item below is an expense you bear as a car owner. Fill in the blank for the items that relate to your situation. Figure a monthly cost.

Cost of the Car* $_____
Registration Fee $_____
Inspection Fee $_____
Garage Rental $_____
Insurance $_____
Oil and Gas $_____

Repairs $_____
Maintenance (Tires, Tune-ups, etc.) $_____
Parking Tickets $_____
Highway Tolls $_____
Antifreeze $_____

What percentage of your family's monthly earnings does the purchase and maintenance of an auto represent? ______________________________

What purchasing, ownership, and driving habits can you change and thereby save money? __________
____
____
____
____
____
____

*The monthly cost of the car based upon the purchase price may be found by dividing 60 (months—assuming you will own the car for 5 years) into the final purchase price (plus interest charges if, as most, you finance the car). The new car described on page 149 in Unit 10: Consumer Environomics is used for the following example:

$3090.00 sticker price
390.00 discount (no trade-in; see below)
2700.00
700.00 your down payment
$2000.00 amount to be financed (@ 13.38% for 36 months)

$2700.00 net cost of car
216.00 8% sales tax on net cost
439.00 finance charges
$3355.00

$3355.00 ÷ 60 = $55.92 monthly cost during the five years you own the car

Frequently, you may get a better discount when purchasing an auto if you do not have a trade-in; and you may also receive more for your used car if you can sell it privately. Remember that, when you dispose of this car in 5 years, its value at that time has the effect of lowering your monthly cost for the 60 months you owned it (e.g., $600 value ÷ 60 = $10/mo.; thus, your monthly cost was actually $45.92).

Procedures

- Discuss the comparative advantages of the suggested, but not yet produced, alternatives to present autos.

- In lieu of immediate production of such alternative vehicles, should the use of the internal combustion engine be drastically restricted?

- If yes, how could this be done and by whom?

10.] The following concepts or ideas about transportation, some of them quite radical, should be developed through class discussion in terms of pros and cons, and alternatives. Some of the ideas will necessitate that the students do some outside reading.

Consider whether or not:

- All transportation (air, rail, bus, taxis) other than personal automobiles should be nationalized.

  The following excerpt from a Long Island Newsday editorial seems to succinctly portray one viewpoint—

  > "European nations learned long ago that trains can be a fast, cheap, clean, energy-efficient way to move goods and people, and they no more expect railroads to show a profit than their armies or fire departments. In an era of rising transportation costs, pollution, traffic congestion, and energy shortages, railroads contribute far more to a nation's well-being than any balance sheet can indicate."

- The owner of an automobile which weighs in excess of 3000 pounds and/or possesses a horsepower rating greater than 150 should be taxed on the basis of these excesses.

- Automobiles should be permitted to operate between 6:00 a.m. and 6:00 p.m. only on the perimeters of major city centers.

- Federal transportation funds should be granted only to communities which develop or improve mass transit systems.

Performance Indicators (Outcomes)

Suggest workable alternatives to the private automobile as basic transportation.

Describe "nationalization," its advantages and its disadvantages.

Procedures

Performance Indicators (Outcomes)

- Private ownership of gasoline-powered surface vehicles should be phased out so that their use would be limited to licensed/approved vital services.

Have the students take the last proposition one step further and discuss the impact of a state of "car-lessness" on the following:

- rural or suburban school systems
- drive-in theatres
- motel/hotel industry
- shopping centers

Support a hypothetical situation or case study with specific details.

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UNIT 8: POLLUTION

Background

"There is no way for society to avoid paying for pollution. If we do not pay for prevention, we pay in other ways — in lost recreational uses of rivers and beaches, in higher treatment costs for drinking water, in damage to crops, forests, and buildings, and, most importantly, through higher medical bills, time lost because of illness, human suffering, and premature deaths." (Russell E. Train, EPA)

A current water resource map of the United States would show most of our waterways to be polluted or in imminent danger of being polluted. Air quality in our major population areas, despite controls, is unhealthy and may easily worsen if air pollution standards are relaxed because of the energy crisis. Noise levels in cities, near major highways, and beneath air lanes are intolerable. Local ordinances for the regulation of outdoor advertising and power line siting coupled with community planning through enlightened zoning are only beginning to have an effect on the frequently squalid vistas of cities and suburbs. The disposal of solid waste has become a major problem which will require even more serious attention than it has yet received.

We must keep in mind however, that pollution cannot be eliminated, it can only be controlled. According to the law of conservation of matter, matter can neither be created nor destroyed, but only changed from one form to another. We may control pollution or convert waste to less obnoxious forms, but ultimately we must alter patterns of consumption, reduce aspirations to affluence, and control population size in order to reduce pollution.

General Understandings

- Humans have exercised a presumed right to exploit the environment with little regard for their responsibility to preserve it.
- Any one of an environment's components, such as space, water, or air, may become a limiting factor.
- In order to preserve our threatened environment, present attitudes must change to reflect a widespread public concern which will encourage protective action by people, groups, and government.
- Water and air are reusable and transient resources, but the usable quantities may be reduced by impaired quality.
- We must devise ever more efficient means of recycling the results of our technology.

Procedures	Performance Indicators (Outcomes)
1.] Discuss with the class how humans get water and what human requirements for water are.	Understand human water needs.
• How much of the human body is water?	Determine the sources of water for your home and community.
• What percentage of total body weight does water represent?	

Procedures

- How much water must be replaced daily in the human system? (2.5 liters)
- How much of this is taken into the body by drinking? (1.3 liters)
- Determine the amount of drinking water needed during a lifespan of 70 years.
- Illustrate or explain the water supply system in your home.
- Trace this home water supply to its source and relate the source to the hydrologic cycle.
- Develop a chart of local water sources or label a map of your locality to show water sources (include reservoirs, artesian wells, lakes, rivers and streams, and pumping stations). Label areas near the sources of water as potential pollution problems.
- Determine your own household water usage and compare it with the information in the table which follows. (Check the accuracy of the table estimates by comparing them, and your use figures, with those of some of your neighbors.)
- Determine water use during a one-week period in the home. How much is used for cooking, washing, bathing, and waste disposal?
- Investigate the amounts of water used for individual appliances and prepare a table showing the results.

WATER USE IN THE HOME

Dishwashing	10 gals.
Toilet (1X)	3 gals.
Shower	20-30 gals.
Bath	30-40 gals.
Clothes washing (1 load)	20-30 gals.

Performance Indicators (Outcomes)

Assess the relative efficiency of personal water consumption.

Procedures

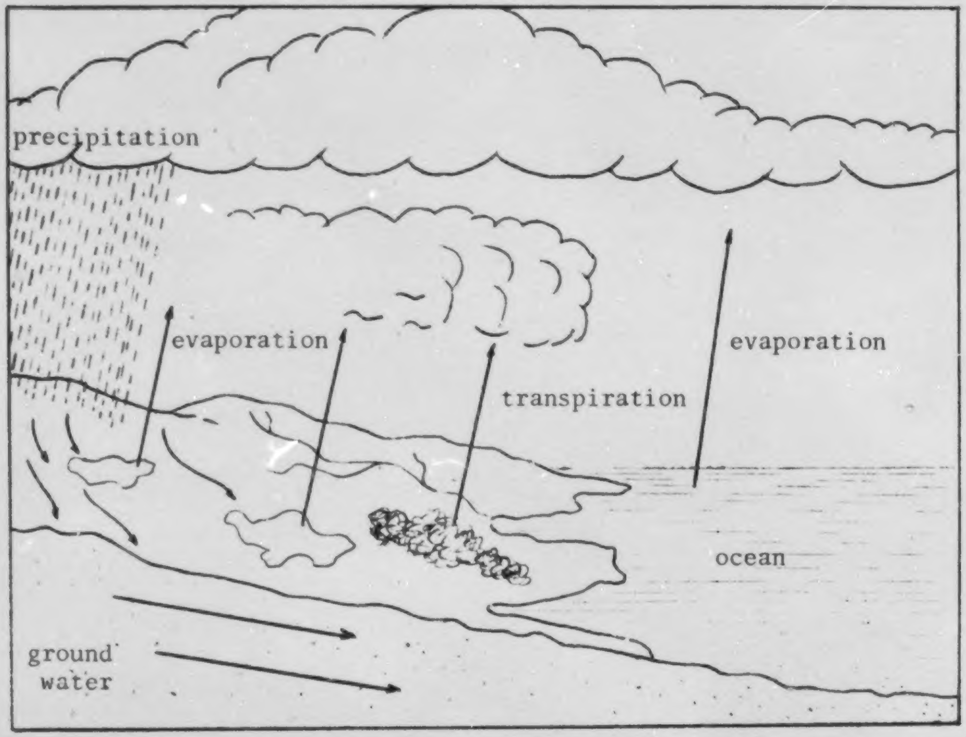
Performance Indicators (Outcomes)

- Determine annual water consumption figures (all uses) for the United States and discuss in terms of: rate of demand growth; regional shortages; treatment and purification capacity; and health problems.

2.] Ask the students to produce a drawing of the hydrologic cycle similar to the one below. The drawing should be accompanied by a description of how water proceeds through the cycle, beginning with water vapor from the ocean.

Illustrate the hydrologic cycle, explaining how water proceeds through it.

HYDROLOGIC CYCLE



- What is an aquifer? Explain the phrase "water table."

- What happens to ground water runoff?

Explain the difference in the disposition of ground water runoff in nonurban areas as opposed to its fate in cities.

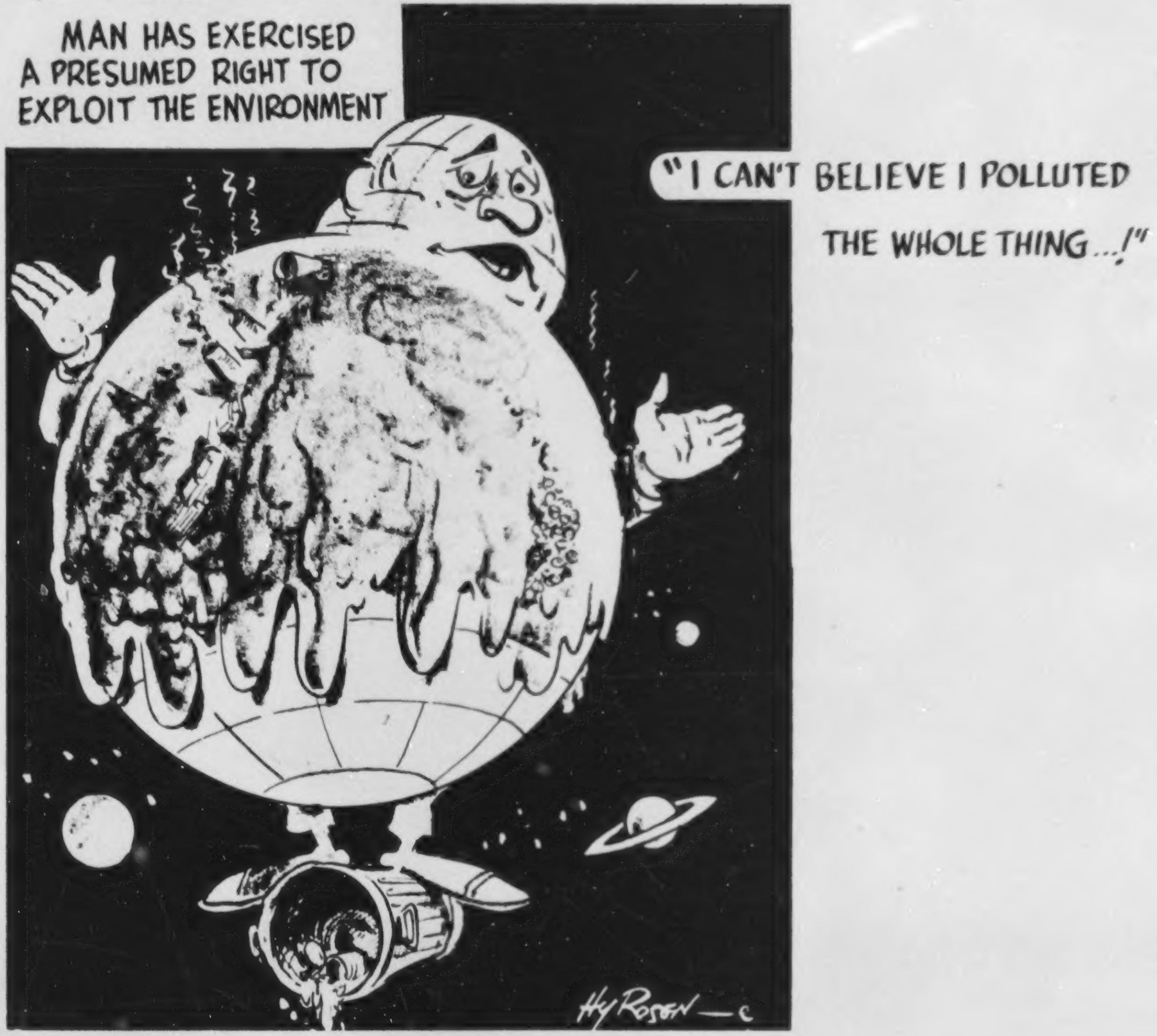
Procedures	Performance Indicators (Outcomes)
3.] Assign students the task of contacting local water authorities to determine the quality of potable water and the type of treatment used to water to make it potable. • What are the exact allowable amounts of bacterial, suspended solid, color, odor, and salt pollutants in potable water? • What governmental agency is responsible for performing water quality tests? • If chlorination is the method for "purifying" the water, how is it introduced into the system? Is the amount monitored? • Describe other methods of purification.	Determine the quality of domestic water supplies.
Investigate water pollution in your area. Have the students use a map of the area in locating major bodies of water in the locality. (See Procedure 2.) They should then relate the location of paper mills, food processing plants, and other industrial operations to this information. • Consult with the local public health agency or environmental protection office concerning the quality of water locally. • Describe the pollutants or effluents being discharged into the water by industry. • What happens to these pollutants? • What are the sewage treatment facilities for your community? Are they adequate? Explain.	Understand the impact of industry upon water quality.
Assign a group of students the task of reporting on local sewage treatment facilities. Have these students illustrate and explain primary, secondary, and tertiary sewage treatment plants.	Evaluate local water treatment systems in terms of adequacy and efficiency.
Ask another group of students to summarize,in a report to the class, the water quality legislation which is in effect at the local, State, and Federal levels.	

Procedures

Performance Indicators
(Outcomes)

For future study, assign research on the quality of water in the Great Lakes, Lake Tahoe, Lake George, Lake Champlain, and Lake Baikal.

- What is eutrophication?
- What systems of water pollution control and water purification exist for these lakes?
- Suggest pollution abatement measures for one of the lakes studied.


MAN HAS EXERCISED A PRESUMED RIGHT TO EXPLOIT THE ENVIRONMENT
"I CAN'T BELIEVE I POLLUTED THE WHOLE THING...!"
Hy Rosen ©

Procedures	Performance Indicators (Outcomes)
4.] Relate the following to the class:	
Polluted waters have transmitted a wide variety of diseases. In an 1850's cartoon, the river Thames was portrayed as a "father" presenting his "children" (dysentery, typhoid, cholera) to the city of London. During the period 1831-1893, 50,000 Londoners died from a cholera epidemic. At the beginning of the 19th century, life expectancy was only 30 years due in large part to the ravages of waterborne diseases. Currently, 200,000,000 people worldwide are thought to suffer from a modern plague called schistosomiasis.	
Have the students prepare a brief, written report on schistosomiasis. Assign a small group of students the task of preparing a poster which illustrates the life cycle of *schistosoma haematobium*. **They should describe and define: cercariae; miracidia; snails; flukes, and eggs in this cycle.**	Define schistosomiasis.
• **What is the vector in the cycle?**	
• What role does raw sewage play in the transmission of the disease?	
• What has been the effect of the Aswan High Dam on the spread of schistosomiasis?	
• What has been the effect on irrigation on the spread of the disease?	
• Prepare a map showing the distribution of the disease worldwide.	Summarize the incidence of worldwide waterborne diseases.
5.] Instruct the students to read "How To Kill an Ocean," by Thor Heyerdahl (Saturday Review, November 29, 1975).	
• Describe the transoceanic drifts of Kon-Tiki, Ra I, and Ra II.	Describe the significance of transoceanic drift in terms of water pollution.
• What is the global problem with regard to the oceans?	
• What misconceptions do most people have about oceans?	

Procedures

- What is the future of the oceans likely to be?
- Consider offshore drilling for petroleum and the oceanic transportation of oil in terms of their impact on the oceans.
- Maintain a log of ocean pollution disasters.

6.] Distribute birthday candles to teams of students. After lighting the candles, the students should make as many observations as possible on the burning candle.

- What is required for the candle to burn?
- What is the source of oxygen for the burning candle? Does the candle burn completely?
- What materials are emitted or remain after the candle has burned for awhile? Where do these emitted materials go? What happens to them?
- How is energy used? Is it truly consumed?

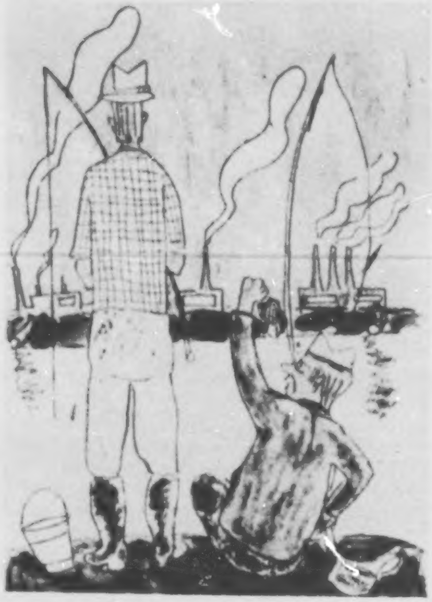
Discuss the content of the major components of clean, dry air (Nitrogen 78%, oxygen 21%, carbon dioxide 0.03%). Discuss the major sources of these components and their major uses.

- How much air do you personally require during a 24-hour period? Conduct an experiment in which you measure the number of inhalations per minute (do this several times to get a good average). Measure the volume of one "normal" breath of air (displace water from a large bottle).

Have students determine the population of a given area of your city or town. They should contact the Mayor's office, Department of Highways, Planning Department, and the Zoning Department for information on parks and green spaces in the area.

- How much green space is there per citizen in that given area?

Performance Indicators (Outcomes)



Krokodil Moscow

"Yes, fish are rich not only in phosphorus but also kerosene, benzine, heavy oil, and sulphur!"

Investigate a problem, stating the purpose of the investigation.

Make observations, gather data, and make inferences based on the collected data.

Procedures	Performance Indicators (Outcomes)
• Consider this fact: the total oxygen requirement of a community of 1,000 people (including using fuels for heating, autos, etc.) can be balanced by a 440-acre park. The green space will "use up" carbon dioxide and release oxygen to the atmosphere.	
• What percentage of the total urban land you investigated is developed as park land? In your opinion is there an even balance between the oxygen-carbon dioxide cycle for that space? Support your opinion with data and facts.	Use mathematical principles to support an opinion.
7.] Divide the class into research teams to investigate the components of air which are considered air pollutants. Each team should report on the structure of the pollutant, emitting source, effects on the environment, effects on human, plant, and animal health and the current controls and standards pertaining to the pollutant. The teams should present oral and written reports on their findings. Groups should be assigned to investigate carbon monoxide, sulfar oxides, nitrogen oxides, particulate matter, hydrocarbons, ozone, aerosols, lead, fluorides, and asbestos. Teams should be assigned to investigate, differentiate, and report on: smog and photochemical smog; and the environmental tragedies of Donora, Pa., London, England, Tokyo, Japan, and the Meuse Valley, Belgium.	Name the common air pollutants and their sources. Describe the relationship of air pollutants to human health.

We pay a price in pollution for every bit of energy we use. The less we waste, the more we'll gain in smog-free air and pure water.

Procedures

8.] Elicit from students a listing of the six major air contaminants. (Provide each student with a copy of "Air Contaminants" and "The Sources of Air Pollution" from pages 6, 7, and 8 of It Stacks Up, New York State Department of Environmental Conservation.) (Also, see the graphs on page 121.)

- What other sources of air pollution are there in addition to industrial?
- Which contaminants come from each source? Prepare a chart showing contaminants and sources.

Provide students with the "New York State Air Classifications" map, also from It Stacks Up, New York State Department of Environmental Conservation, page 26.

- In which region (I, II, III, IV) is your community located?
- What is the air classification level for your local area?

Invite a representative from your Regional Office of the Department of Environmental Conservation to explain the standards set for the major contaminants: sulfur dioxide; particulates; carbon monoxide; photochemical oxidants; hydrocarbons; and, nitrogen oxides. Ask the representative to discuss the background and purpose of the 1970 Clean Air Act. (See pages 25, 16, and 17 of "Summary of Ambient Air Standards - Federal and State," It Stacks Up.)

- What agency established the 1970 Clean Air Act?
- What are ambient air standards?
- What role did the 1970 Clean Air Act play in setting ambient air standards?

Conduct an action program by organizing students into groups of three.

- Ask them to use their knowledge of air pollutants and sources to make a list of the types of industries located in their community which might be responsible for the air classification level of their area. A bus excursion fieldtrip would be an effective way to survey industries in the community.

Performance Indicators (Outcomes)

Classify local air quality.

Explain the purpose and provisions of the 1970 Clean Air Act.

Define ambient air standards.

Procedures

- Have each committee prepare questions to be used in interviewing a spokesman from a local industry. The questions should be phrased as technically as possible with regard to ambient air standards, and should be designed to elicit the positive steps taken by the company to meet these standards.
- Prepare a composite set of questions from those submitted by all groups.
- Invite a representative from three local industries to meet with students and react to the prepared questions.
- Construct a chart, similar to that which follows, to organize and clarify the data obtained from the interviews.

Sample Air Quality Survey Summary

Contaminant	General Source	Air Standard	Positive Step Taken By Industry

After the interviews with industrial representatives, discuss the following:

- What progress has been made by these industries since 1970 in meeting the ambient air standards?
- How do the three industries studied compare with each other in their efforts to meet ambient air standards?

Performance Indicators
(Outcomes)

Interview industry spokesmen on the subject of air quality.

Procedures

- How can citizens report air-polluting incidents to the authorities? Who are the proper authorities? Why should citizens do this?

9.] Reproduce copies of the two graphs on p.121 for student use. Ask students to examine the data on these graphs and to discuss the following questions.

- What pollutants are added to the air by the automobile?
- Automobile engines release into the air about 700 grams of carbon monoxide for each gallon of gasoline consumed. Calculate the amount of CO emitted by your family car during one week ... during one year.
- Most atmospheric sulfur comes from the burning of coal. Which categories of pollutant sources (as shown in the second graph) are primarily responsible?
- What percentage of the total discharged pollutants do hydrocarbons represent? Learn the sources of hydrocarbon pollution.
- What additional measures will need to be taken to reduce emissions from the five major sources shown in the second graph?

10.] If feasible, acquire the excellent and comprehensive Noise Pollution Chart available from Roy G. Scarfo, Inc., P.O. Box 217, Thorndale, Pa. 19372. (Also available are the Air Pollution Chart and the Noise Pollution Chart.)

Obtain a meter that is calibrated to read decibels. Have the students record noise levels in a wide variety of settings and locations, comparing their readings with those on the chart.

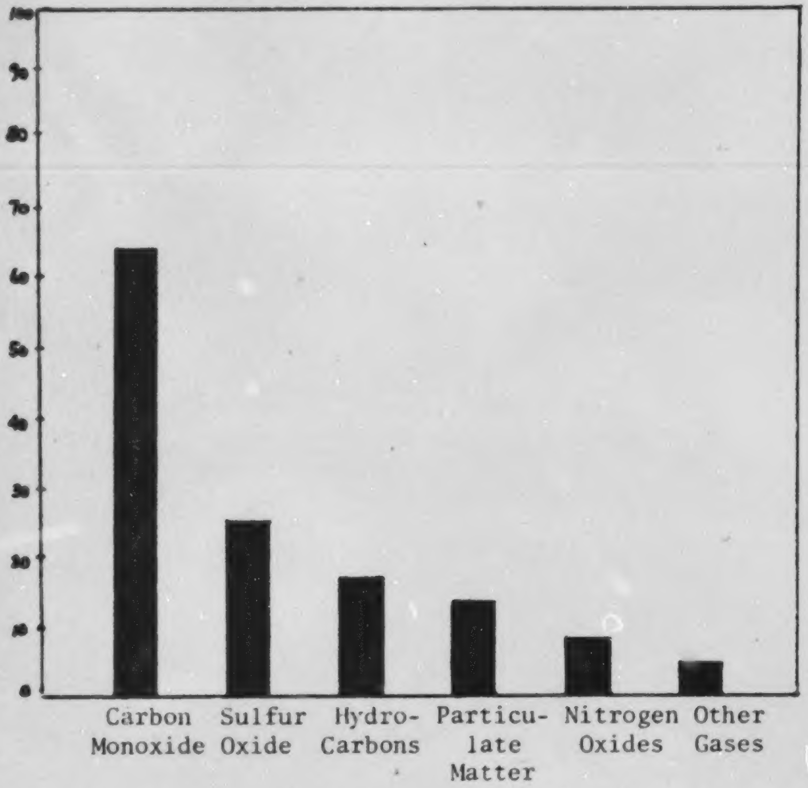
- Describe types and levels of noise pollution which result in economic loss (property damage).
- Discuss the health ramifications of noise pollution.
- What steps have been taken by State and Federal regulatory agencies to minimize hazards related to noise pollution?

Performance Indicators
(Outcomes)

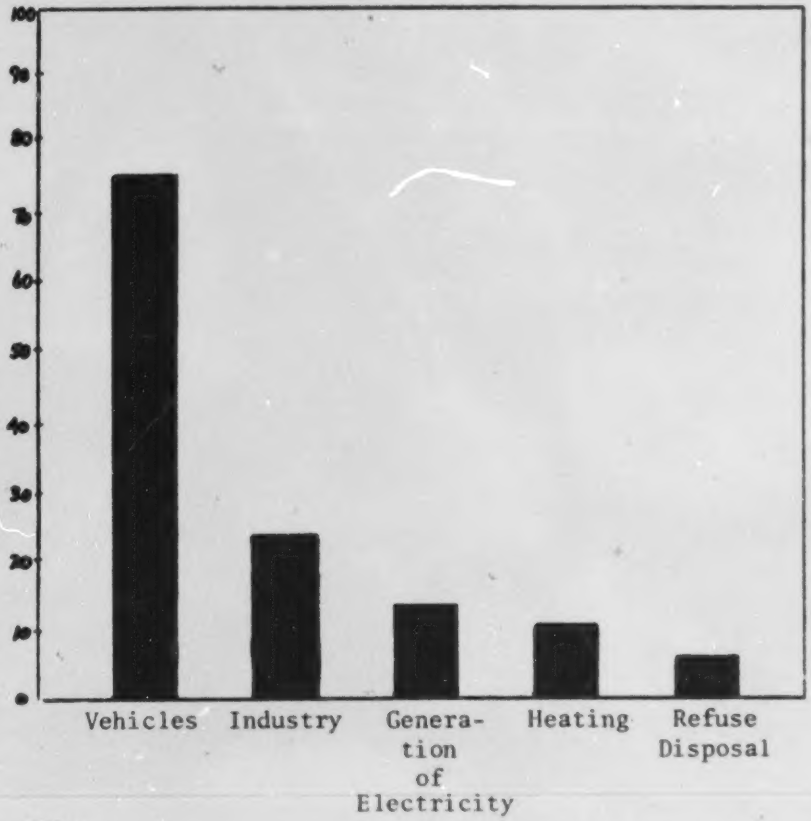
Describe the impact of the automobile on air quality.

Measure noise levels and determine their effect on human activity.

Pollutants (Millions of Ton/yr.)



Sources of Pollution (Millions of Tons/yr.)



Procedures	Performance Indicators (Outcomes)
11.] Divide the class into committees, assigning one of the following investigations to each group.	Explain how solid waste is disposed of in the community.
• Visit apartment buildings, stores, and schools to inquire about methods of disposing of garbage. What is thrown away and how? How do disposal methods work? Which ones are more effective for what types of problems? How complete is the disposal?	
• Contact the local sanitation department and ask what is done with large quantities of garbage. Discuss the pros and cons of the system and any alternatives that exist.	
• Write to the sanitation department of a large city and inquire about their methods of garbage disposal. What are the city's major disposal problems? How does its system fit its needs and how does it differ from the method used in your community?	
• Research the history of sanitation systems and show how disposal methods have changed with the changing needs of our society.	
• Make a list of the kinds of items thrown away in your home. Check the various ways of home garbage disposal. What method do you have and which is most effective? How can you improve your system?	
• Investigate ways that corporations and industries are polluting the environment through improper waste removal. Write to these businesses expressing your concern.	
• Conduct research to learn of local ordinances governing dumping and burning of solid waste. Determine the number and nature of violation citations issued the previous year.	
• Map a given locale and outline open spaces, highways, parks, open dumping sites, junk cars, and general litter. Record the worst areas on film for a class presentation.	Describe local solid waste problem areas using maps, charts, and film.
• Determine the health and safety hazards produced by the situations recorded above.	

Procedures

Performance Indicators (Outcomes)

- Cut out reports on junk and waste from local newspapers.
- Write or call the county health department and local officials for information about means of litter, junk, and waste control and for copies of specific regulations about each.
- Invite a speaker from the health department or sanitation department to discuss specific questions. (Note: Outline the questions beforehand.)

- Locate and map the site of the local landfill. Distribute the map to the class. Be sure the map includes the following:
  - location of the landfill relative to streams and bodies of water
  - location of the landfill relative to highways, housing, and population
- Plan, outline, and execute a plan to inform the public about the solid waste landfill. Include all proper and improper functions of the landfill and the laws and regulations governing collection and disposal of solid waste.

At the completion of the committee work, discuss with the class how the results of their investigations will change their personal and family habits related to consumption and waste.

Discuss with students the areas of public health affected by the problem of solid waste (i.e., survival, epidemics, desirable quality of life, human productivity).

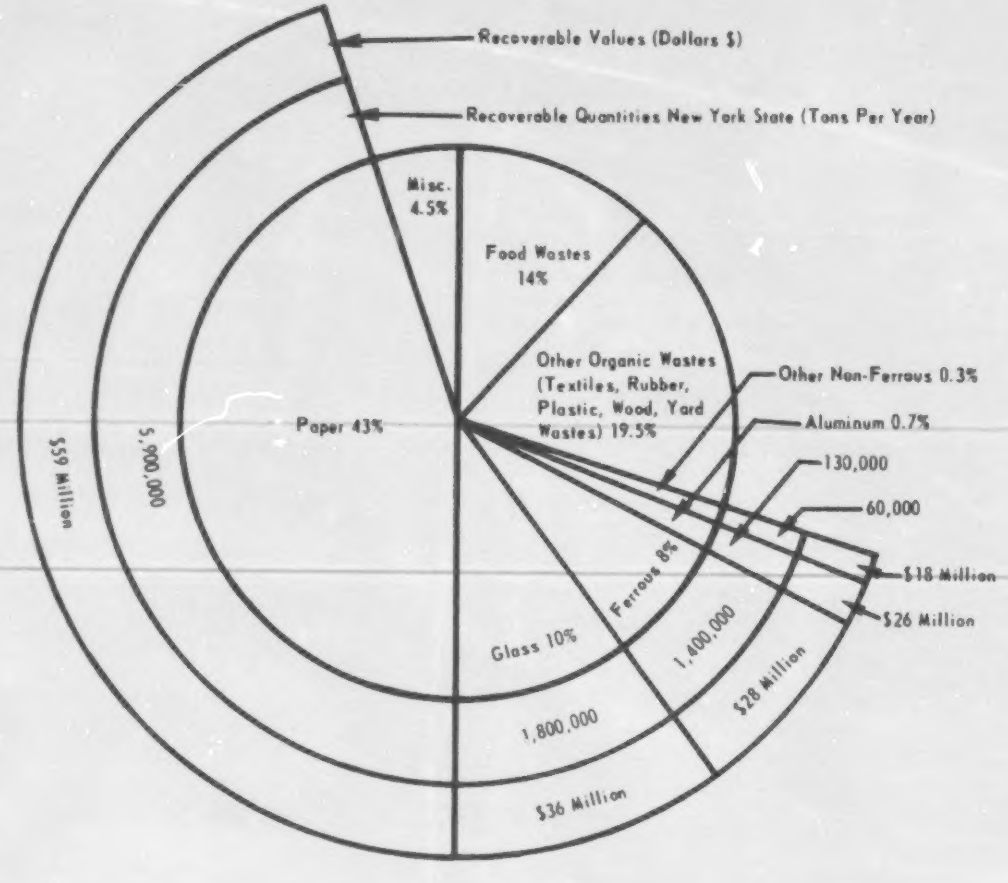
Explain the relationship of solid waste disposal to human health.

Discuss media and how effectively various modes of communication convey messages regarding environmental health.

Have students read the special report "Solid Waste as a Resource" in the October 1, 1974, issue of New York State Environment (Department of Environmental Conservation, Albany, N.Y.) With that as a background, discuss the chart on p. 124.

Describe the resource value of solid waste.

AVERAGE COMPOSITION OF MUNICIPAL SOLID WASTE IN NEW YORK STATE AND RECOVERABLE MATERIALS



Procedures

- Which type of solid waste would appear to be most profitable to recover? Which would be the most practical? Explain.
- Which solid wastes would be the least profitable to recover?
- What is the total dollar value of New York State's recoverable materials?
- Do the size and nature of your community warrant an investment in a recovering process? What besides money should be considered in this decision?

12.] Discuss with the class the solid waste problem of a city like New York.

Landfilling has been the primary means of disposing of New York City's daily production of 26,000 tons of solid waste. It's cheap and relatively simple. But, now New York doesn't have much land left to fill. High costs, legal, and political problems make it next to impossible to transport our solid waste for disposal outside the City. Incineration, which prolongs landfill life by reducing the volume of garbage, is on its way out, too, because of the increasing costs of air pollution control devices required by city, state, and Federal governments. So, solving the City's mounting solid waste disposal problem requires some innovative thinking and some hard decisions.

In preparing a master plan, a city task force has followed the approach taken by many other cities and states — namely, high technology resource recovery of materials and energy. (See "The Magic Black Box" on the next page.*)

Reproduce "The Magic Black Box," and discuss this proposed solution to the problem of solid waste in heavily populated urban areas.

- What are the advantages and disadvantages of such a process?

Performance Indicators
(Outcomes)

Give examples of solutions to the solid waste problems of major urban areas.

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*From The Waste Paper, January, 1977, Environmental Action Coalition, 156 Fifth Avenue, New York, N.Y. 10010.

- Should other cities adopt this plan?
- Have any other cities developed innovative appraches to the problem?

The Magic Black Box

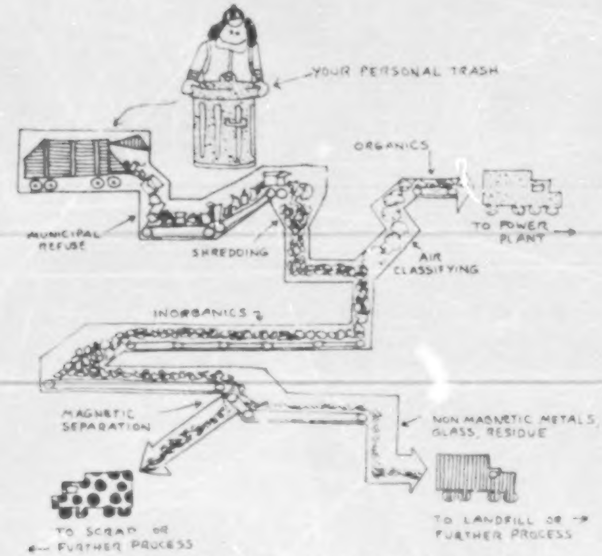

Diagram shows "front-end" of resource recovery system.

A typical total high technology resource recovery system consists of two phases – the "front-end", or materials recovery system, and the "back-end", or energy recovery system. At the front-end, refuse is first passed through a shredder, reducing it to small pieces. Next, the shredded refuse moves through an air classifier. Here, a high velocity column of air blows the light, organic materials out the top, while the heavy, inorganic fraction drops to the bottom. The heavy fraction, mostly non-combustibles, consists of ferrous (iron) and non-ferrous metals (primarily aluminum), glass, stones, dirt, and other inorganic materials. Most resource recovery systems will remove the ferrous metals, which can be economically separated out by magnet and sold for recycling. But since the technology and economics of aluminum and glass recovery are still questionable, few systems presently attempt to reclaim these materials.

Phase two, or the "back-end", utilizes the light fraction of the refuse. The light fraction, primarily combustibles, consists of paper, plastics, textiles, rubber, food waste, wood, lawn clippings, and other organics. There are a number of potential uses for this fraction (approximately 70% of our solid waste), but at present, the most remunerative use is as energy. Refuse is valued at $15 to $20 per ton when used as fuel. Refuse derived fuel (RDF) has about half the BTU, or heat value of eastern coal.

The energy recovery technologies include: (1) the generation of steam in an incinerator fueled *solely* by unprocessed solid waste. The steam is used for heating and cooling of housing and commercial complexes, for industrial processing, or for the generation of electricity; (2) the use of a solid refuse-derived-fuel (RDF) as a supplemental fuel to coal or oil in electric utility boilers; and (3) the use of pyrolysis, which converts solid waste into gaseous or liquid fuels. Pyrolysis is a process involving the decomposition of materials by heating in the absence or near-absence of oxygen.

All of these energy recovery technologies are being considered for application in New York City.

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UNIT 9: ENVIRONMENTAL HEALTH (Chemical, Biological and Radiological Contamination)

Background

"Today we are plagued with chronic diseases that an increasing number of health experts believe are largely caused by environmental factors — where we work or live, our habits, diets, or lifestyles. The more sophisticated and sensitive our monitoring devices become, the more data we accumulate on the health effects of pollutants and other agents in the environment and, the worse things look."*

"There was once a town in the heart of America where all life seemed to live in harmony with its surroundings. Then a strange blight crept over the area and everything began to change — everywhere was a shadow of death. A grim specter has crept upon us almost unnoticed — and this imagined tragedy may easily become a stark reality we all shall know." Rachel Carson's words from an imaginary scenario in 1962 admonished us regarding the indiscriminate use of the "elixirs of death," the pesticides. While she highlighted the arsenal of chemical weapons contrived by science since World War II to check hordes of insects, plants, and related pests, this unit goes beyond the pesticide problem to increase the student's awareness of, and concern for, all the chemical, biological, and radioactive contaminants which pose threats to our health and our very existence.

How tolerant we are of the foreboding news stories in the media — "Tragedy in Hopewill" (pesticide incident, 1976); "260 Unexpected Deaths in Day-N.Y.C." (probable air contaminants, 1953); "800,000 Die Annually in Sub-Saharan Africa" (malarial parasite, 1976); and, "Toxin Suspected as Mystery Killer" (possible bacterial toxin a killer in Philadelphia, 1976).

Why have such environmentally related disasters as these been allowed to continue year after year? Why do humans, almost suicidally, create many of these insidious conditions for life already threatened by population pressures, other pollution problems, political and religious strife, and periodic environmental upheavals such as floods, earthquakes, and volcanic eruptions?

"The battle against diseases must increasingly be fought, not simply in the hospitals and doctors' offices, but in our streets, homes, and workplaces; in our air and water; in our food and products; and in our habits and lifestyles. Such a shift in emphasis will require a searching re-examination and radical revision of our popular understanding of, and our public approach to, health care and disease. If environmental disease is becoming 'the disease of the century,' as it appears to be, then environmental protection must become the most important ingredient in any national health program."*

General Understandings

- The preservation and improvement of public health necessitates that present attitudes must change to reflect a widespread public concern which will encourage protective action by individuals, groups, and government.
- Pollutants and contaminants in the air and water are produced by natural and manmade processes.
- Despite their benefits, pesticides produce a number of undesirable and harmful side effects.
- Inorganic chemicals and minerals comprise the vast array of acids, salts, and finely divided metals or metal compounds that may increase the salinity, acidity, and toxicity of water.

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*Russell E. Train, Administrator, U.S. Environmental Protection Agency.

Procedures

1.] Provide each member of the class with a copy of the following passage and challenge the students to complete it at as high a "knowledge level" as possible. (Key on p. 131.)

A harmful substance deposited in the air, water, or on land which leads to a state of dirtiness, impurity, or unhealthiness is termed a(n) ____(1)____ or a(n) ____(2)____. Three specific types of contamination threatening human health and survival are ____(3)____, biological, and radioactive. An array of metallic ____(4)____, such as arsenic, lead, mercury, cadmium, nickel, and zinc, possess properties which, at certain concentrations can disrupt various life functions of the human organism. This condition is usually termed ____(5)____. Sulphur dioxide, carbon monoxide, nitrogen dioxide, lead arsenate, and potassium cyanide belong to a multitude of contaminants chemically classified as ____(6)____, because their structures consist of combinations of different atoms. The aforementioned substances are termed ____(7)____ rather than organic. Organic chemicals contain chains of the element ____(8)____, high concentrations of ____(9)____, and often many other different elements and groups. Some of these are very complex, insidious in their effect on human tissue, and therefore even more ____(10)____ or poisonous than the former. Included in this category are: dichlorodiphenyltrichloroethane or ____(11)____, polychlorinated biphenyls or ____(12)____, parathion and nicotine sulfate.

Our industrial complex has produced and we have distributed tons of chemicals to "improve" our living standard: ____(13)____ to destroy insect pests; ____(14)____ to eradicate weeds and other plants; ____(15)____ to control rusts, smuts, molds, mushrooms, and yeasts; ____(16)____ to improve the chemical makeup of the soil for farming and gardening; and even high phosphate ____(17)____ to facilitate our washing.

An arsenal of chemicals has been created to control the environment or has been produced as the waste of technology. Further contamination by ____(18)____ agents such as animal, plant, and human diseases, their respective wastes, pests, and even warfare preparations has been accelerated by human activities. As a consequence of human error, carelessness, and/or laxity, the following pathogenic organisms have frequently caused environmentally related ____(19)____ in spite of the expertise and efforts of modern medicine: the ____(20)____ of typhoid, cholera, shigellosis, salmonellosis,

Performance Indicators (Outcomes)

Cite three major contaminants threatening human health.

Contrast inorganic with organic chemical contaminants.

Give the names for at least three different types of pesticides.

Recall the five main causative organisms of communicable diseases.

Procedures

gonorrhea, syphilis,and botulism; the ___(21)___ of infectious hepatitis, psittacosis, and yellow fever; the ___(22)___ of malaria, and amebic dysentery; the ___(23)___ of histoplasmosis, and coccidioidomycosis; and the ___(24)___ of ascariasis, echinococcosis, trichinosis, hookworm, schistosomiasis, and tapeworm.

Radioactive contaminants affect the environment and human health in a manner much less understood than those of chemical or biological origin. These contaminants are produced in the preparation of ___(25)___ fuel; in the production of electricity by nuclear ___(26)___; as ___(27)___ products of nuclear weapons tests; by the accidents, tailings, and seepage which occur in ___(28)___; by the ___(29)___ of radioactive wastes; through laboratory ___(30)___ with radioactive materials; and from the general use of x-ray and microwave radiation forms.

Rating Scale

30 - 21 correct.......environmental genius
20 - 11 correct.......not bad
10 - 0 correct.......improvement needed

Answer Key

The teacher may or may not wish to provide the students with the following answer list in a random arrangement at the outset of the activity.

1. pollutant
2. contaminant
3. chemical
4. elements
5. poisoning
6. compounds
7. inorganic
8. carbon
9. hydrogen
10. toxic
11. D.D.T.
12. P.C.B.s
13. insecticides
14. herbicides
15. fungicides
16. fertilizers
17. detergents
18. biological
19. epidemics
20. bacteria
21. viruses
22. protozoa
23. fungi
24. worms (parasites)
25. nuclear
26. reactors
27. fallout
28. mines
29. disposal
30. accidents

Review the activity with the students to reinforce their vocabulary.

Performance Indicators (Outcomes)

List at least five causes of radiological contamination.

Procedures

2.] To more clearly understand the terms concerning chemical, biological, and radioactive contamination, provide each group of five students with five "vocabulary pairs." Each member of the pair must be clearly defined and then contrasted with its partner. Direct each group to select a leader to present its findings to the entire class. At this time encourage the members of the class to develop a notebook for important terms.

- chlorinated hydrocarbons - organophosphates
- safe residue - p.p.m (parts per million)
- persistent (pesticide) - permanent (pesticide)
- tolerance level - toxicity
- biological control - broad spectrum (pesticide)

- carcinogen - additive
- F.D.A. - E.P.A.
- high phosphate (detergent) - biodegradable (detergent)
- nitrates (fertilizers) - phosphates (fertilizers)
- eutrophication - potable drinking water

- metabolic poison - cumulative effect
- photochemical oxidant - particulates
- plague - "environmental epidemic"
- B.O.D. - bacterial toxin
- pathogenic - passive immunity

- fission - fusion
- dosage (radioactive) - decay (radioactive)
- half-life - radioactivity
- lethal dose - radiosensitive
- meltdown - reactor

- thermal pollution - nuclear energy
- particulate radiation -electromagnetic radiation
- radiation sickness - ionization effect
- r.a.d. - radioactive isotopes
- cosmic radiation - mutations

Performance Indicators (Outcomes)

Explain the meaning of 40 key terms in the contamination categories: chemical (15); biological (10); and radioactive (15).

Procedures

Performance Indicators
(Outcomes)

Terms describing specific chemicals (methylated mercury, kepone); biological contaminants (fecal waste problems, names of pests and disease causing organisms); and radiation forms (alpha, beta, gamma, X-ray, R.V.) will be encountered in the ensuing activities of this unit.

3.] Chemical, biological and radioactive contamination incidents are documented in our newspapers and magazines generally on a weekly basis. Divide the class into groups of three and instruct them to search at least one newspaper and one magazine for this type of news item during a period of one week. Require the members of each group to prepare a poster depicting their headlines in the most interesting manner possible—collage, overhead projection transparency, etc. The poster should include a collection of headlines in at least two of the categories—chemical, biological, and radioactive contamination. The teacher may wish to add additional specifications for the poster construction. (See sample on page 140.)

When the students have completed this assignment, require a member of each group to present the poster to the class and to highlight the main points of each news story behind each headline. After all the presentations have been made, employ these questions with the class to promote a summary discussion.

Construct a poster depicting the main points of a news story.

- Which contamination category was reported most frequently by the news media?
- What measures have been taken to correct contamination incidents of this type?
- Who was responsible for these incidents? What individual group and/or organization is attempting to prevent such incidents?
- In what part of the world did they occur?

4.] Involve your class in the selection of three of the following case histories designed to increase the students' awareness of the chemical biological and radioactive contamination of humanity. For each case history or incident selected, organize the students into "problem-solving committees of four" as follows: a victim (living); an official from the State Public Health Service; a member of

Procedures

Performance Indicators
(Outcomes)

the Environmental Protection Agency; and, a representative of the State Senate investigating committee. Using the information provided, each group should attempt to solve the contamination problem by:

(1) identifying the probable causative contaminant

(2) locating the probable source of the contaminant (that is, the process by which the contamination occurs)

(3) recommending ways to stop the contamination process which is threatening human health and the environment

(4) recommending a procedure to rectify the damage done by the contaminant to human health and the environment

Identify four of the steps necessary for the solution to a contamination incident.

After each of the four groups has submitted a written report answering the questions above, the work should be graded on the basis of realism, logic, adherence to directions, and clarity.

A. "Deadly Dust"

Cite five effects of a chemical contaminant on the human body.

Human Condition

Eighty of 140 workers at chemical plant affected by a substance as follows: nervous system afflicted/muscular tremors/anxiety and nervousness/loss of memory/speech defect/cerebrum affected/liver and spleen damage/possible sterility/possible cancer.

Environmental Status

Region contaminated as follows: major rivers; tidal waters along ocean coastline contain substance/fresh water, estuarine, and salt water fish and mollusks, large specimens, contain undesirable p.p.m. of substance/recreational and commercial fishing for certain species banned.

Substance a possible air contaminant.

Procedures

Performance Indicators (Outcomes)

Transmission

Substance absorbed through human skin enters blood stream. Entry also possible through ingestion of contaminated muscle of fish, a result of food chain concentrating tendency.

B. "Methyl Menace"

Human Condition

One hundred eleven die, 19 congenitally defective babies born in fishing village. Symptoms of afflicted: numbness and tingling of lips, hands, and feet/ataxia (lack of muscle coordination)/disturbances of speech/ blurred or restricted vision/impaired hearing/diarrhea/loss of appetite/ metallic taste/emotional disturbances/possible permanent brain damage to a fetus. Contaminant concentrates in the liver, spleen, kidneys, blood, saliva, lining of small intestine, muscles, bones, and especially, the brain.

Environmental Status

Discharged into water by plastics manufacturing plant, contaminant is acted upon by bacteria in mud bottom of ocean bay. Bacteria convert contaminant into methyl form which is water soluble and can be involved in food cycles by algae, green plants, invertebrates, and fish. Fish, as consumers, concentrate the contaminant in their kidneys, livers, and muscles.

Transmission

Substance internalized by ingestion of contaminated fish and birds.

Procedures

Performance Indicators (Outcomes)

C. "Meltdown"

Background

The phone call came in mid-morning, Wednesday, June 17, 1978, from the huge plant on the Hudson River - "meltdown" - a major break in a coolant pipe of the reactor resulting in a temperature increase in the core of the vessel. A coincidental fire in the emergency backup system caused the emergency core cooling procedure to fail. Result: temperature and pressure increase excessively, causing the core substance to "melt" through the containing vessel, "melt" through the concrete slab of the reactor, and release contaminated steam through the crumbling reactor wall. The emergency sprinkler system also failed. The probability of a serious accident, one in 20,000 for this typical plant, has been converted into a dreaded incident - "meltdown"!

Explain at least three events in a nuclear reactor "meltdown."

Human Condition

No loss of life at plant/most of technicians exposed to the contaminating steam/plant physician and local health authorities predict the following symptoms for those affected: immediate—headache, dizziness, abnormal senses of taste and smell, nausea, vomiting, diarrhea, decrease in blood pressure, decrease in number of red and white blood cells, fatigue, and irritability. Long-range—serious anemia, leukopenia, infection, loss of body fluid, circulatory collapse, hair loss, possible cancer, possible transmission of genetic defects through chromosome aberrations, and possible death.

List five of the immediate signs of radiation sickness.

(All of the above symptoms depend upon the degree of exposure.)

Environmental Status

Southwest wind carries "contaminated cloud" across populated New York and into New England. Contaminants threaten the lives and health of thousands of humans and impinge upon plant and animal life in both terrestrial and aquatic environments. Some of the contaminants decay to become harmless in several hours or days; others will take thousands and millions of years to lose their potency. Physiological damage to life in the environment specifically is caused by damage to cells—cell membranes punctured and broken; the swelling of mitochondria; the disruption of membrane permeability; the loss of sodium; the destruction of lysosomes; chromosome breaks; and, a decrease in D.N.A production which affects mitosis (cell division and growth). The adverse psychological effects of the contaminants on humans and other animals are unpredictable since they cannot be seen or measured in any conventional manner.

Transmission

Contaminants penetrate skin and sometimes internal organs and/or are inhaled with the air or ingested with affected water and food, thereby invading the internal anatomy another way.

D. "Man's Best Friend"

Human Condition

Four hundred sixty-one children in large city exhibit these symptoms: increased white blood cell count (eosinophils)/enlarged liver/lungs inflamed/other organs affected in some cases/general irritability/ eye inflammation/blindness in several cases/and death for six due to complications with pneumonia and other secondary infections. Affected children range in age from one to four. Adults are not afflicted during this epidemic.

Cite five affects of any biological contaminant on the human body.

Environmental Status

Canine fecal wastes steadily increase in large urban areas; consequently, the human contaminant proportionately increases to cause a disease condition, especially in children.

Transmission

Contaminant transmitted to mouth from fecal material source, then to intestine, liver, lungs, and other parts of the body via the circulatory system.

Procedures	Performance Indicators (Outcomes)
5.] Direct the students to review the concepts and important terms encountered in the past simulation activities by playing the game, "contamination BINGO."	Define 10 terms associated with the simulation activities.

- Divide the class into five groups of five each. Appoint a leader for each group.
- Provide the leader of every group with a blank "BINGO" card.
- Employ a set of previously prepared, 2 centimeter squares on which 25 terms have been printed and correspondingly numbered with the spaces on the students' card (see suggested terms on next page.)
- Through random selection of each term, "call" the term (G-3, for instance).
- The first group to define the term correctly is awarded the square for placement on the appropriate space on its card.
- If the group misses the term called, the square is returned to the set.
- "Call" the terms until a group scores "BINGO" or until all terms are used up.
- Repeat the game.

Procedures

Performance Indicators
(Outcomes)

	B	I	N	G	O
1	E.P.A.		Kepone		
2		X-ray			
3			contaminant free		feces
4	carcinogen		p.p.m.	meltdown	
5					toxicity

25 terms for "Contamination BINGO Review"

EPA
Lethal dose
Methylated mercury
Meltdown
Alpha
Beta
Gamma
X-ray
Genetic defect
Feces

Metabolic poison
Broad spectrum insecticide
Biological Control
Toxic substances Control Act
Nuclear proliferation
Radioactive waste disposal
Particulate radiation
Toxicity
Environmental carcinogen
Pathogen

p.p.m.
Kepone
Cumulative effect
F.D.A.
U.V.

Tragedy in Hopewell

LEAD POISONING ALERT FOR PARENTS

Researchers find new links

Cancer found everywhere

Blast rocks nuclear plant

Nuclear Fallout Sprinkles East

THE BUGS ARE COMING

Kepone traces found in fish

THE PHILADELPHIA KILLER

The Perils of PCBs

Resources

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UNIT 10: CONSUMER ENVIRONOMICS

Background

With price levels rising, with finite resources predictably decreasing in availability, and with population growing, the competition for available goods and services dramatically increases. The need for environmentally sound patterns of consumption is more dramatic than ever. How we behave as consumers will greatly influence price levels, finite resource longevity, and, to some extent, population growth.

Consumer credit has encouraged wasteful consumption which shows little concern for sound environmental goals. The recent increase in the sale of gasoline-guzzling large autos (after a decline linked to the energy crisis) in the spring and early summer of 1976 is in part traceable to the attitudes toward, and encouragement of, installment purchasing.

Buying prepackaged foods and foods in fast-food restaurants rather than using natural foods, hoarding rather than buying prudently, purchasing to enhance social status rather than for need, encouraging built-in-obsolescence with our votes in the marketplace are all value decisions as well as economic ones. We must begin to question some of the values upon which these decisions are based and examine alternatives.

American society in contrast with others is considered wasteful. The overpowered car, the need for kitchen trash compacters because of the deluge of packaged goods, the disdain of public transportation, except in airline travel, are all signs of this wasteful indulgence. Part of this may be a result of our highly competitive, profit-oriented economic system. Because an activity is profitable, Americans, so long blessed with seemingly endless resources, will continue to be wasteful. Thus consumers, including industry and government, must be educated in the interdependence of the natural environment with human activities.

Instead of the endless production of unneeded goods and wasteful services, we must continue to find ways to better utilize the limited resources that remain; not for more and bigger automobiles, but in accordance with our actual needs of safe, adequate housing; reasonably priced health and medical care; urban revitalization; safe, comfortable transportation available to all in a lifestyle of reordered priorities. Growth and expansion are inevitable, but they must be tempered by planning, understanding, and reason.

General Understandings:

- Individual and group consumption patterns have significant consequences upon various aspects of the environment.
- Costs of packaging, advertising, and merchandising consumer goods and services are often environmentally, as well as economically expensive.
- Built-in obsolescence and lack of product durability may bring results which contradict sound environmental goals and the best interests of society.
- Impulse buying by consumers is done at the expense of both the buyer and the environment.
- A desire to achieve or demonstrate social status leads to wasteful consumer decisions and unfortunate outcomes.
- The rate of resource consumption increases in direct proportion to the expansion of our wants, needs, and markets.

- Consumer advocacy, consumer interest groups, consumer publications, and consumer resources are available to represent, inform, and assist the individual consumer.
- American society, generally speaking, is characterized by conspicuous consumption and waste.
- Values and priorities must be re-examined and alternatives considered in the production, use, and disposal of goods and services in American society.
- Instruments for resource allocation, development and consumption, in addition to "price, profits, and the marketplace," must be found. The concept that more is better must be re-examined.
- Advertising propaganda techniques, easy credit, and installment buying, are all factors which lead to wasteful consumption by Americans of all income levels.
- Consumer advocacy groups generally support pro-environmentalist positions on consumerism that emphasize the concept that less is more.
- Choices between essential needs and non-essential desires are often in conflict.
- Consumer decisions are based upon the trade-offs between desires and costs (concessions).
- Persuasive advertising, easy credit, and consumer ignorance are all factors which distort the understanding of "opportunity cost."

Procedures

1.] Have students maintain an accurate log of consumer activities for themselves and their families over a period of two weeks. The record should include regular items used, such as food, transportation, energy. Selecting at least one item or service from each of the major areas of these personal and family expenditures, record where the item was obtained, its dollar cost, whether or not recycling is possible, and an estimate of packaging costs for the item. Share your results in class.

- In what ways do some of these consumer practices adversely affect the environment?
- Describe any wide variations between your own practices and those of your family, your classmates, and their families.
- Why might some individuals and/or families resist taking part in a survey such as this?

Performance Indicators
(Outcomes)

Identify at least two consumer practices and how they affect at least two areas of the environment.

Describe some of the economic and environmental costs which result from advertising, packaging, and merchandising of one or more major commodities and services consumed by an individual or family.

Procedures	Performance Indicators (Outcomes)
• Which of the items were purchased impulsively? • Discuss comparison shopping. How can it save the consumer money? Can it be environmentally wasteful at the same time? Explain. • Based upon this survey, what specific consuming habits seem to be environmentally wasteful? • Compare a family shopping list with what is actually purchased. Note unanticipated "extras."	
Ask students, when they visit large supermarkets or discount stores, to make a list of the merchandise displayed to encourage impulse buying. Add to the list the loudspeaker announcements and other gimmicks that are used in persuading consumers to purchase thoughtlessly or needlessly.	Distinguish between impulse buying and carefully planned, reasonable purchasing patterns.
• If possible, ask the store manager to describe the effectiveness of such approaches and list the types of items which are offered for sale in this way.	
2.] Direct students to continue the log for an additional two weeks. Distribute a budget and record of expenses form similar to the one on the next page. Have the students complete their forms, using the data from their logs. If the percentage of income for any of the items of expense seems excessive or disproportionate, this may be compensated for in the next step which is to ask that a budget of anticipated expenditures or spending limits, determined by income, be developed using the same forms.	Budget personal or family expenditures in an attempt to live within one's means.
• Name each expenditure which is reduced to fit the new budget and explain how or why this particular economy was chosen.	
Request that the budget be developed again, this time reflecting those savings which the students believe may be effected by making environmentally enlightened consumer choices (e.g., cheaper, public transportation vs. costlier, private auto maintenance; fewer convenience foods; etc.)	Make consumer choices which are economically and environmentally beneficial.

Procedures

Budget and Record of Expenses for March 1977

Money available______ Money spent______ = Difference (+ or -)________

Category and/or Item	Amount Budgeted	Weeks				Total Amount Spent	Percent of Income
		1st	2nd	3d	4th		
Food							
Transportation							
Private auto*							
Public (commuting)							

(*See Unit 7: Transportation, p. 97 for an explanation of how to determine the monthly cost of owning and operating a private automobile.)

- Describe several of the instances in which you found that budgeting with environmental stewardship as an objective had the added benefit of being economically advantageous. Why was this?

3.] Almost half the population of the United States is under 21 years of age. As consumers, many of these young people are likely to exercise poor judgment in purchasing due to a lack of experience in the marketplace. Frequently, this faulty judgment is caused by failure to discriminate between necessities and luxuries, and by the influence of advertising on the purchases made.

Performance Indicators
(Outcomes)

Itemize monthly expenses.

Procedures

Have a class committee conduct a survey of the class to determine which common consumer goods they consider necessary (essentials, or needs) and which seem to be simply desirable (nonessentials, or wants). Consider the following:

- Are needs the same for all students? Why? Can the members of the class agree on what is necessary? Why may this be difficult to do?
- Are there any students who consider some items essential while a majority of the class disagree? If so, what are their reasons for these choices?
- Once a list of essentials is generally agreed upon, ask students to consider the list as though they were young consumers in a developing nation such as India or Nigeria. Would any of the essentials now be considered nonessential? Why, or why not?
- If people in developing nations were to define essential and nonessential the way we do in America (and had the wherewithal to pursue these desires in the marketplace), what would be the effect on world resources?
- Name several nonessential consumer items you probably would anticipate purchasing during the next 12 months. How would your life be changed if you didn't buy them?

Have the class develop a list of ways that producers, through advertising, attempt to convince consumers that nonessentials are indispensable to them. The list should be supported by newspaper and magazine clippings. In the discussion that follows, ask students:

- What are some examples of how you have been swayed by the power of advertising?
- Did you realize that you very often advertise products for a retailer or a manufacturer? Some examples of this are: labels in clothing; shopping bags that you carry away from the store; or, a dealer's name permanently affixed to the automobile you buy. What are other examples?

Performance Indicators (Outcomes)

Distinguish between "needs" and "wants."

Determine the extent to which purchasing is influenced by advertising.

Procedures

Performance Indicators
(Outcomes)

- Should manufacturers and retailers get this type of free advertising? Can you do anything about it if you object?
- What are some of our scarce resources which are further diminished by successful advertising campaigns for more modern products, greater "convenience" in packaging, and other "technological innovations?"
- What are some ways in which the power of the advertising industry might be used constructively in terms of our resource and energy problems? Is it likely that advertising will change its approach? Explain.

Consumption is continually being increased and a large part of the increase is a result of the producer's ability to create wants. This expansion of production in turn increases the rate of resource use.

In connection with this stimulation of artificial "needs," have the students categorize products by the following types of advertising appeals:

Identify five common types of advertising appeals.

-emotional
-logical
-creative (humorous, artistic)
-testimonial
-psychological

Ask students to:

- Identify explicitly each commercial or advertisement to which they refer.
- Show how business has created needs in areas where no need existed 25 years ago... 50 years ago... 75 years ago.
- Use economic statistics to show, in graph form, actual growth in the areas selected for the question above.

Graph new product growth.

- Identify the areas of growth chosen as examples of renewable or nonrenewable resources. Explain if necessary.

Procedures

Advertisers use a variety of techniques in their appeals to consumers. Some of the more common ones are listed below. Once students have become familiar with the types, ask them to select an example of each from magazines, radio, or TV. This activity lends itself to either an individual or class exercise.

Performance Indicators (Outcomes)

Become familiar with the most common advertising techniques.

basic ad - a straightforward approach that encourages purchase of a product by giving facts about it

celebrity ad - encourages purchase of the product because it is used by a famous person

the new and improved ad - encourages purchase of a product because it has been improved by additives

research ads - encourages purchase of a product because statistics have proven its value or acceptability

senses ad - encourages purchase of a product by appealing to one or more of the five senses

youth ads - encourages purchase of a product by appealing to youth and to older people who want to feel young and to keep up with the times

family ad - encourages purchase of a product by showing a happy family using it

romantic ad - encourages purchase of a product by suggesting use of it will increase popularity with the opposite sex

environmental ad - encourages purchase of a product because it is not harmful to the environment

popularity ad - encourages purchase of a product because everybody else uses it

expert ad - encourages purchase of a product because an expert recommends it

nostalgia ad - encourages purchase of a product because it suggests a return of the "good old days"

humor ad - ads that provoke laughter are apt to be remembered and it is hoped that products will also be remembered

4.] Review with the class the reading, THE CONSUMER, THE ENVIRONMENT, AND THE AUTOMOBILE, which was referred to in Procedure 5 of Unit 7, Transportation. For all the automobile has contributed to the nation's industrial development and mobility, it remains one of the least advisable investments of capital that an individual or a family can make.

Procedures

- Why is the automobile a poor investment in economic terms?
- Learn how an automobile is depreciated.
- Why is the automobile an environmental "disaster?"

Below is a reproduction of part of a price sticker from the window of a new automobile. Have students examine it and answer the questions which follow.

2 DOOR SEDAN (1977 MODEL)	$ 2682 00
INCLUDES AT NO EXTRA COST:	
ALL-VINYL BUCKET SEATS	NC
MANUAL FRONT DISC BRAKES	NC
SADDLE BRONZE METALLIC /5T/	
2000 CC 2V 4-CYLINDER ENGINE	NC
SELECT-SHIFT CRUISE-O-MATIC	220 00
FIVE 6.00X13 BSW TIRES	NC
REAR WINDOW DEFOGGER	32 00
AM RADIO	61 00
TOTAL OPTIONS	313 00
TRANSPORTATION CHARGES	95 00
TOTAL	$ 3090 00

- List the three options on this new car and the cost of each.
- How much money could be saved by buying the same car without the options?
- By not purchasing the options, what besides money could be saved?

Performance Indicators (Outcomes)

Understand the relationship of automobile depreciation to its value as an investment.

Suggest ways of improving the personal and environmental economics of automobile ownership.

Procedures

- Are the options absolutely necessary, or could the car and the driver function well without them?

- What would be the effect of these options upon your anticipated maintenance, repair, and gas consumption expenditures during your ownership of the car?

Discuss the dependence upon the automobile by the American public and what effect its increasing use has had on the environment. Consider all aspects of the environmental effect: land use for highways, parking lots, etc; effect of engine emission on the environment; petroleum consumption; unlimited use of nonrenewable materials used in automobile manufacture; and, disposal of worn out automobiles.

- What approaches could be taken to encourage auto manufacturers to develop lower energy-consuming and polluting power systems?

- What approaches could be taken to encourage automobile users to purchase more economical cars with fewer resource-wasting accessories?

- What measures could be taken to encourage automobile users to switch to public transportation?

5.] Discuss the topic of "Product Quality" with the class, allowing individuals to cite instances wherein they have been disappointed with the durability, quality, or performance of certain consumer goods.

Have the class develop an extensive list of the most commonly purchased "durable" goods including appliances, auto accessories, and entertainment equipment (cameras, sound systems, etc.). Assign to individuals the task of researching consumer product journals to determine the life expectancy and frequency of repair for each item.

The students should then design a chart illustrating this information along with purchase price and an annual cost based upon price and lifespan of the product. For example:

Performance Indicators
(Outcomes)

Recognize the impact of the automobile upon our environment; consider especially the decline of urban centers, including their business districts, as compared with the growth of suburbs.

Procedures

Performance Indicators (Outcomes)

Product	Purchase Price	+	*Frequency of Repair (Life)	X	*Average Repair Cost	÷	Expected Life (yrs.)	=	Annual Cost
Refrigerator	$500.00 (plus tax?)		2		$50.00		15		$40.00

(*If it is impractical or unrealistic to gather information on frequency of repair and/or estimate repair costs, eliminate these columns and merely divide expected life into purchase price.)

- Interview your parents and grandparents. What are their opinions regarding the quality and durability of consumer goods now as compared with those of 20 or 30 years ago?

Through interviews, compare product quality of today with that of a generation ago.

- What can you find out about the newly-invented, lifetime light bulb?
- In the matter of product quality, what else is at stake besides the consumer's budget or pocketbook? Explain.
- How important are the consumer guide publications which are available? Do you use them? Why or why not?
- What does "planned obsolescence" mean? Whose plan is it?
- If a national chain of muffler shops can guarantee its products and work for the "life" of a car, why are the warranties provided by auto manufacturers so limited and restrictive?
- Can you describe any other, similar product quality inconsistencies?

Procedures

Take a fieldtrip to an appliance repair shop and some auto repair shops. Discuss with employees some of the most common problems and breakdowns they encounter. If possible, arrange student observations of the repair process, making particular note of repair problems caused by styling and "designed for looks" features of appliances and automobiles. At an auto repair shop, try to obtain reactions and viewpoints of the service people on various anti-pollution devices required on automobiles.

- Was the repair shop licensed by the State or by a private association; or neither? Would this make any difference in repair charges. Explain.
- What arguments could be used to convince an automobile repairperson that anti-pollution devices are installed for the benefit of all?
- How is it possible for many people to get "ripped off" by repair shops? Does deliberate design or built-in obsolescence create a situation in which a repair person is forced into less than ethical situations?

Make a survey of State and Federal consumer protection legislation since 1968. Evaluate the effectiveness of this type of legislation.

- Does the effectiveness of consumer legislation wax and wane according to broader economic conditions? Explain.
- To what extent is the environment a consideration in this type of legislation?
- What economic pressures affect the environmental aspects of consumer legislation?

6.] Summarize this unit on environmental consumerism (Consumer Environomics) with the series of procedures and questions below. To begin with, have the students bring to class several different brands of a common food item such as peanut butter. Discuss:

- How do these different brands compare in general appearance: color, price, weight, ingredients, and taste? Record the findings on a chart.

Performance Indicators
(Outcomes)

Develop an awareness of some of the economic forces and pressures which encourage the design and production of goods with "built-in" obsolescence and short-lived durability resulting from lack of effective consumer protection legislation and environmental controls.

Procedures	Performance Indicators (Outcomes)
• Which, if any, do you prefer? Why? How do these preferences relate to appearances, price, weight, and ingredients?	
• Which of these brands do your families use? Who in the family decides which brand is brought? On what basis?	
• What does "house brand" mean? Which of the brands studied are house brands? How do they compare with the name brands?	Define: "brand name;" "house brand;" and, "additive."
• What are the factors which influence people to buy certain brands?	
• What can we learn about a product by reading the label?	
• What are food additives? Which of the brands observed had additives?	
Conduct a class study to learn what ingredients are in six or eight popular brand name food products ("X" soup, "Y" cereal, "Z" white bread). Use products suggested by the class. Have students go to the local supermarket, read the labels, and record the information on a chart.	Check and compare the ingredients of popular food products.
• Which of these products contain additives?	
• Why are additives used?	
• Do we need additives? Explain.	
• Are there reasons for avoiding their use?	
• What role does the government play in protecting consumers from harmful or unnecessary additives?	
• In what other ways does the government protect consumers?	
• Which agencies has our city set up to protect consumers? ... our State? ... the United States?	

Procedures	Performance Indicators (Outcomes)
Ask the students to conduct a consumer price comparison survey. Discuss the advantages of comparative shopping. Set up a comparative shopping chart.	Conduct a comparative shopping survey using "unit-price" information available in supermarkets.
• How do the ingredients in the house brand compare with those in the name brands studied? How does the price per ounce compare?	
• Did all of the stores surveyed have house brands?	
• Does the price of the name brand product vary from store to store? If so, what might account for this? What does "caveat emptor" mean?	
• Explain and discuss the problem of prices in "corner" or "neighborhood" stores.	
• If a house brand is cheaper than a name brand, and of equal quality, why do people buy the name brand?	
• Why do some people shop in the most expensive stores?	
Analyze the role of advertising in consumerism by considering the following:	
• How can we make advertising work for us? With the class, plan a satisfying and nutritious dinner. Decide on the quantities needed for a family of four. Divide the class into committees. Ask students to bring in copies of the pre-weekend newspaper and study the food store advertisements as a preliminary to their imaginary shopping expedition. Have committees compare their decisions and the total cost of their dinner.	Use advertised specials in order to reduce food costs.
-Which varied more in price: staples or meat and produce? -What is a "loss leader"? -Did the newspapers carry coupons offering any of the items free or at a reduced rate? How can companies afford to make these offers? -If convenience foods were to be used, what difference, if any, would it make on the cost and nutritional value of the meal?	
• How does advertising work against us? Have students make a list of the various ways companies advertise their products (newspapers, magazines,	

radio, television, billboards, self-advertising packaging). Bring in a collection of newspaper and magazine ads. Listen critically to radio and television commercials.

-What methods do companies use to sell their products?
-How well do claims made by advertisements compare with the reality of the product's performance? (Set up classroom tests to check some of the claims.)
-How can publications such as Consumer Reports help determine the truth behind advertising claims?
-Do we need all of the products we buy? Do we have items at home which we bought because of advertising and do not really use?
-In what ways do retailers encourage "impulse" buying?

Instruct the class to develop a consumer questionnaire, or use the one below, for surveying the consumer habits of adults the students know. Have students; devise the questions; decide who should be polled; conduct and survey, and tally the results.

CONSUMER SURVEY

	YES	NO	COMMENTS
1. Do you buy namebrand products? Why, or why not?			
2. Do you ever buy "house brand" products? Why, or why not?			
3. Do you believe the claims made in advertisements? Why, or why not?			
4. How does advertising influence your buying?			

Arrange demonstrations of product performance to test advertising claims.

Procedures

Performance Indicators
(Outcomes)

	YES	NO	COMMENTS
5. Do you switch from one brand to another? Why, or why not?			
6. Do you think we need so many different brands for the same products? Explain.			
7. Do you think we need the chemical additives put in our foods? Why, or why not?			
8. If you buy a product that doesn't live up to its advertising claims, do you complain to anyone? To whom, or why not?			
9. Do you think the Food and Drug Administration is doing a good job to protect the public? Explain.			
10. (a) Do you use "convenience prepackaged" foods? Why or why not? (b) If yes, what difference does it make in your food budget?			

- What trends were observable?

- Were inconsistencies noted? For example, did many respondents indicate that they bought name brands but claim they were not influenced by advertising?

- Did many people state that they have bought things they did not really need? Why did they make the purchases?

Procedures	Performance Indicators (Outcomes)
Pose the question, "Do we as a Nation overconsume?" Encourage students to report on the huge quantities and varieties of foods and other products found in supermarkets. Ask them to note where some of these foods come from. • Do Americans eat and live better than people in some of the countries from which we import specialty foods and other products? • If an affluent country such as the United States can afford a higher standard of living and have more than people in other countries, do we also have a right to keep on consuming food and other products at an ever-increasing rate? • Do we have a right to continue selling and buying products made from or dependent on natural resources which have become scarce? • Is the present economic "crunch" having an effect on your family and our national buying habits? Explain.	Describe the varieties of food products available and record the sources of imported foods.
Discuss "planned obsolescence." Have we fallen into the habit of throwing away what we have and buying more? What evidence is there of this?	Explain the meaning and environmental significance of "planned obsolescence."
Involve the class in the following evaluative questions. • Since starting this unit, have you asked your parents to buy an item you heard advertised on television or radio? Explain. • Do your parents check the price per ounce on an item before buying it now? Why, or why not? Explain "unit pricing." • Will such checking be easier or more difficult when we convert to metric units? Explain. • Do your parents read labels to see if the food item contains additives? Why, or why not? • Have you "thought twice" before throwing away an old toy? ... to what purpose?	

Resource

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UNIT 11: GLOBAL RESOURCE MANAGEMENT

Background

All people consume resources. Many of our environmental problems today result from the ways our forefathers and we have used and misused these resources.

The major resources are land, soil, air, water, plants (food crops, forests), animals, and minerals. They are used singly or in combination, in their natural state or through processing, to satisfy human needs and desires. They are either renewable or nonrenewable. All of the resources listed above, except minerals, are considered renewable because, through management, treatment, reforestation, and other means, they may be restored or replenished. Nonrenewable resources such as petroleum, copper, zinc, and gold, on the other hand, are limited in supply and may eventually be depleted.

In recent years, considerable attention has been given to resource management problems in the United States and other industrialized nations. Published figures which indicate that the United States has only 7% of the world's population, yet consumes 30% of the world's resources and creates 50% of the world's pollution have gained widespread credibility. These figures and others like them lend credence to the concept of a global international resource management system, yet this concept has been slowly and dimly perceived, particularly by the general public.

The interdependence of all nations and peoples of the world in economic, political, and social concerns has been a truism since the early 20th century. Recognition of this fact, at least in economic terms, has been obvious in the growth of supranational corporations, and worldwide efforts at reducing trade and commerce barriers.

Political interdependence has not developed as clearly or as rapidly. Extreme nationalism, anti-colonialism, and cold-war and religious rivalries have been dominant political facts of life in the world from the midpoint of the 20th century. Unfortunately, these political developments have tended to overshadow the growing interdependence of the world's nations and people. The struggle for resources, until recently, has been won by the industrialized western nations. However, the 1970's portend a shift in power balances as the developing and underdeveloped nations, some rich in the vital resources needed by the industrialized few, begin to challenge the dominance of the others.

The basic issue involving resources is how they will be developed and managed for the greatest good over the longest period of time. Public policy over the use of natural resources in a post-industrial American society is one of the most difficult areas in the environment vs. economy controversy. In the world, the question is one of guaranteeing an equitable distribution of declining resources and insuring the well-being of all. Can we use and manage our renewable and nonrenewable resources in an intelligent way, insuring security for further generations, and still have a healthy world economy?

The time has long since passed when industrialized nations can consider the less developed areas of the world as plantations and mines to be robbed and looted for the benefit of the exploiter. Hopefully, the time has also passed when ultra-nationalistic demagogues may consider the resources of an area or group of nations as a means of international blackmail.

Resource interdependence now and in the future is as obviously necessary as is the fact that we are all inhabitants of spaceship earth and are, like it or not, inextricably bound together.

General Understandings:

- Plant and animal populations represent renewable resources but are dependent themselves on proper resource management and control; so-called endangered species earn this title usually because of human interference with natural processes and cycles.
- The renewable resource base can be extended by growth, reproduction, management and recycling.
- Developments in technology and social and economic changes all affect the availability and quality of resources.
- The unequal distribution and availability of resources help bring about conflicts over priorities in the development, management, and preservation of these resources.
- As non-renewable resource supplies diminish the freedom of the individual, corporation, government, or other entity to use the resources without restraint is reduced.
- An essential task in democratic societies is to gain acceptance by the majority that resource restrictions and allocations are not incompatible with basic democratic values.
- Man must acknowledge that the interdependence of all living things dictates the manner in which and the extent to which resources may be used.
- Natural resources exist and have value interdependently, and the use or misuse of one will affect others.
- Historically, cultures with high technological development have used disproportionately more natural resources than those with lower levels of technological development.
- Individuals, societies, and governments tend to select short-term economic gains, often at the expense of long-term environmental benefits.
- The rate of resource consumption increases in direct proportion to the expansion of our wants, needs, and markets.
- Resource depletion can be slowed by the development of substitutes for existing (nonrenewable) resources, for prevalent lifestyles, and for current priorities.
- An international organization may be a means of equalizing the economic and environmental development of nations. There are groups of this nature in existance today that are wrestling with these problems.
- The interdependency and mutual needs of nations suggest a "global village" concept.
- The nonrenewable resource base of mineral elements is considered finite, and depletion can only be slowed by altered priorities, new demographic considerations, improved conservation practices, and vigorous recycling procedures.
- Natural resources are unequally distributed with respect to land areas and political boundaries, thus creating conflicts over priorities in the use, management, and conservation of these resources.

Procedures	Performance Indicators (Outcomes)
1.] Ask the class to develop an extensive list of renewable and nonrenewable resources. Group the resources within each of the two types of category when pratical (land, plants, animals, fossil fuels, minerals, etc.). Begin the exercise with a discussion which clearly defines these two major types of resources, renewable and nonrenewable, and provides some examples of each. Students should then give a report on each of the resources in terms: • present availability or known ready reserves • expected availability during next decade; during next several decades • potential for renewing or recycling (for nonrenewable resources) • extent to which the resource is presently managed • potential for conservation in extending the life of the resource • relative priority of each resource as compared with the others • possibility of finding substitutes or alternatives Discuss the results and highlights of these reports with the class.	Distinguish between renewable and nonrenewable resources by characterizing each and giving specific examples. List the variety of resources and their current rates of consumption. Develop a working knowledge of world resource inventories.
• Rank the resources in order of necessity to humans (in terms of survival, subsistence, well-being, etc.). Some may need to receive equal ranking. • List at least five of the mineral resources, including two fossil fuel resources, and next to each name at least five consumer products which are wholly or in part derived from it. How many of those products could you easily do without? Which of these products are generally available in underdeveloped and developing countries?	Recognize the differences in lifestyles between peoples of developing and developed nations.
2.] Direct students to choose a resource* — a mineral, a fossil fuel, forests, etc. Trace its development and use by man as far into the past as possible. After developing the resource's history, project its availability and use into the future for at least two centuries. (Consider representing this in the form of a line graph.) Note past changes in technology, particularly resulting	Develop a detailed report on a specific resource.

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*If it is likely that many students will choose a fossil fuel, request the manual, So What's New and its accompanying history of energy wall chart from the Energy Research and Development Administration in Washington, D.C.

from unforeseen developments. An example would be the growth of the petroleum industry from the time of "King Coal" through the era of the internal combustion engine, and into the future.

- Give specific examples of how the economic incentive of quick profit has been a leading factor in resource exploitation and waste.
- As technology is applied to a particular resource such as petroleum, are the results usually beneficial? Explain.
- Does increasing technology guarantee the best use of a resource in terms of the greatest benefits to the largest number of people? Explain.
- How can attitudes such as self-aggrandizement and short-term economic benefits at the expense of our resources be changed to reflect a concern for the public good and the well-being of future generations?

3.] The nations of the world may be categorized generally as "developed," "developing," or "underdeveloped." Ask the students to prepare, through research, a working definition of these three terms. (Select excerpts from Barbara Ward's book, Rich Nations and the Poor Nations, for the class to read and discuss.) Once these terms are familiar ones, they should list the names of 10 nations in each category.

Distinguish among the various states of economic development exhibited by the world's nations.

Assign students to each of three categories and ask them to gather economic data for all 10 nations listed. The information might be presented as in the sample chart below.

"Developed" (etc.) Nations	GNP	Per capita income	Typical exports	Typical imports

- Characterize the nature of the differences in types of imports and exports from one category of nations to another.

Procedures

Performance Indicators
(Outcomes)

- What trading patterns of the members of each category have developed or are likely to develop?
- Are these differences reflected in the respective GNP and per capita income figures? Explain.
- Note the basic factors, such as energy consumption and capital investment, which emphasize the contrast among the three groups.
- Make three pie graphs (each with three slices, one for each category) showing the proportion of (1) mineral resources consumption, (2) energy resources consumption, and (3) population by category.
- What can be done to redress this evident misappropriation of resources?
- If the developed nations will not accept zero growth, let alone economic regression, how will the world resource reserves accommodate a fairer apportionment of what is essentially a finite resource pool?
- What are some of the reasons for the remarkable industrial development of western nations as contrasted with the developing nations?

4.] Direct the students to develop a chart illustrating all the major resources the United States consumes; the uses to which these resources are put; the status of each resource (exports surplus, imports, self-sufficient, etc.); and, the countries or regions from which the imports (if such is the case) come.

Generalize, with specific examples about the status of resources in the United States.

Resource (Raw material)	Exports	Self-Sufficient	Imports*	From/To	a % of total use*
Petroleum				Saudi Arabia, Canada, Venezuela, etc.	40%
Gold					
Magnesium					
Tin				Malaysia, Bolivia, Thailand	100%

*(imports as a % of total use)

Procedures

Performance Indicators (Outcomes)

- By referring to the chart in Procedure 3, label all the nations in the From column above as D=developed, DG=developing, and UD=underdeveloped. Next, determine the percentage of nations of each type which are suppliers of raw materials to the United States.

- Do any of these trading relationships evoke memories of 19th and early 20th century colonialism and imperialism? Explain.

Review the definitions of colonialism and imperialism.

- Are there some nations which could be suppliers for the United States which are not for reasons other than economic?

- Can you think of any modern-day parallels in which force is used to achieve economic objectives? If so, describe them.

- Do the industrialized nations' current concerns about the limits and location of natural resources suggest that economic imperialism is still with us or that developing nations must be especially careful to safeguard their own interests?

- Was the oil embargo recently imposed on the developed nations such a safeguarding of interests, or was it an unjustifiable form of economic blackmail? Defend your answer.

- Can the fact of the location of many critical natural resources in developing nations be interpreted as an "ace in the hole" which will guarantee that these nations will eventually attain Western living standards? Explain.

5.] A basic element of the theory of international trade is the concept of *comparative advantage*. This idea holds that, in the words of the 19th century economist David Ricardo, "...under a system of perfectly free commerce, each country naturally devotes its capital and labor to such employments as the most beneficial to each..." Simply stated in 20th century terms, comparative advantage refers to the special ability of a country to provide one product or service relatively more cheaply than other products or services.

Explain comparative advantage.

Have the class develop a list of products and services which are produced for export by several Western nations. For those products selected, have the

Procedures

students determine whether their production conforms to the definition above. Namely, is the country effectively exploiting its labor and capital in the production of these goods to the extent that it has a trade advantage or favorable balance of trade as a result?

Then, instruct the class to select several developing nations and list their exportable products and services. Elicit the same analysis of these products in terms of their economic importance in the international marketplace.

- If a nation's comparative advantage lies with the use of labor and capital in agriculture, mining, forestry, or shipping, should it plan to eventually industrialize its economy? If it did, would there be a period in which it would be at a decided disadvantage in marketing these goods? Explain.
- Is it conceivable that any of today's so-called developing nations will achieve a comparative advantage when its economy has a special ability to provide industrial goods and services? (Remember that this speculation must account for what the economic state of today's developed nations will be at that same point in time.)
- Considering the present international marketplace, it would seem to be to the advantage of private industry in the Western trading nations that the developing and underdeveloped nations maintain a complementary comparative advantage (i.e., producing other than manufactured goods). Discuss whether or not you agree with this.
- If the above could be considered an accurate appraisal, can that fact be reconciled with the economic and political aspirations of the non-Western, developing nations? Explain.

It has been suggested that, since circumstances in the United States from 1807 to 1812 forced the country to turn from shipping to manufacturing, this less efficient employment of labor and capital eliminated the United States's comparative advantage for nearly a decade. Obviously, the eventual growth of manufacturing in this country soon permitted this advantage to be reestablished with industrial goods.

Performance Indicators
(Outcomes)

Give examples of nations which effectively exploit their wage/labor and natural resources.

Predict the expected economic development of these three types (D, DG, UD) of nations.

Procedures	Performance Indicators (Outcomes)
• How would American economic history have been changed had the United States been more conciliatory in its foreign policy, thus reducing or delaying the development of industry at home?	
• Would the inevitable industrial development of America have been merely postponed or would it have been severely retarted?	Detail the development of America's present world economic advantage.
• What similarities and differences are there between this situation and that of developing nations today?	
6.] Have students research a major multi-national corporation such as Exxon, Shell, or British Petroleum. Emphasize the many aspects of its operations and the different nations in which it maintains facilities. Compare its holdings, profits and other basic dollar value operations with the total gross national products or national incomes of some developing or underdeveloped nations.	Describe the economic and political role in world affairs of multi-national corporations.
• As multi-national corporations, where do these corporations' allegiances rest in terms of the resources dependence of the nation in which each is based?	
• What problems would arise for these corporations and the nations they "represent" in the event of a serious international dispute, or even war, over resources?	
• What did happen to these oil companies as a result of the recent petroleum emergency in 1973-74? Has their influence been reduced? Explain.	
• Define OPEC (Organization of Petroleum Exporting Countries). What role does it play in determining the availability of petroleum.	
• Name some of the multi-national corporations which presently control major world resources other than petroleum.	
• What is the likelihood that other international resource cartels (define) will emerge in the next decade? Explain.	Define cartel.

Procedures

7.] An extremely provocative issue pertaining to resources has to do with those which the oceans of the world have to offer.

Using current sources such as Facts on File, Deadline Data, and the Readers' Guide to Periodical Literature, develop a list of readings for students about the territorial limits of nations and ocean resources. After they have read some of these, discuss the following:

- Why, historically, have the seas belonged to everyone?
- Generally speaking, what is the policy among nations regarding the "Seven Seas"?
- What is the present* stance of the United States government regarding offshore limits and rights? (*200 miles, effective March 1, 1977)
- Discuss the history and currency of 3-mile, 12-mile, and 200-mile limits.
- What resources are at stake in these arguments over territorial limits?
- What might be the viewpoints on territorial limitations of each of the following?
  -the owner of a fleet of fishing ships
  -the chairperson of the board of a large energy company
  -the governors of coastal states
  -a leader in the union for workers in the petroleum industry

Using the same references as above, assemble as many readings as possible on the "cod wars" between Great Britain and Iceland, 1965-1976. Upon completion of the readings, discuss the following:

- How does this "war" illustrate a need for greater international controls over resources in and under the seas?
- In the event of wide-scale development of aquaculture (ocean farming), what will be some of the changes needed in regulations regarding the use of the seas?

Performance Indicators (Outcomes)

Recognize that natural resources are unequally distributed with respect to land areas and political boundaries, thus creating conflicts over priorities in the use, management, and conservation of these resources.

Summarize the current worldwide controversy over territorial limits.

Explain the food resources potential of aquaculture.

Procedures	Performance Indicators (Outcomes)
• Read about and discuss the "anchovy wars" which took place in Latin American waters in recent years.	
Over 16 nations claim territory and resources on the continent of Antarctica. Although uninhabited by a native population, vast resources appear to be available on and under the continent. Have students research the international agreements on Antarctica and discuss the following.	Describe the types of multinational claims and agreements pertaining to Antarctica.
• What nations have claims in Antarctica?	
• Explain whether or not the current agreements insure an orderly, peaceful, environmentally sound development of Antarctica's resources.	
• What are some further safeguards and procedures that should be negotiated among nations claiming parts of Antarctica?	
• What would be the advantages and disadvantages of placing Antarctica under the control of some international organization such as the United Nations, or placing its resources in the World Bank?	
8.] Direct each student to select one item from the list of nonrenewable resources. Then, suggest each develops a combination of a time line/annotated progress report of the resource from its natural state through its uncovering → extraction → transportation (to use site) → purification → processing → manufacturing → transportation (to wholesaler/retailer) → sale → use (by consumer) → disposal (including transportation and incineration, or burial, or recycling).	Trace a natural resource's path from discovery through eventual disposal.
Have the students briefly describe the environmental impact of each step. A further refinement of the activity (if narrowed to fossil fuel resources) would be to describe the relative efficiency of each step to determine the next energy input required to obtain usable energy at the end.	
• Suggest ways in which environmental impact may be mitigated in the processing and use of these resources.	
• If the resource you chose is in short supply or must be imported, what is the feasibility of finding an alternative or substitute for it?	

Procedures

9.] Ask each student to select four or five nations from the United Nations roster until all nations are represented. The only criterion for selection is that each student's group of nations be comprised of nations of one type (developed, developing, underdeveloped).

The class should then develop a master list of priorities and concerns similar to the one below. At this point, each student will be able to rank the concerns for each of the nations on his or her list, based upon a minimal amount of research and conjecture about those nations' problems and prospects.

The class is now ready to convene as a body to discuss problems, agree upon global priorities, and propose solutions.

PROBLEM AREAS OR ISSUES

mineral resources
food
crime
pollution
energy
endangered species
women's rights
housing
racial discrimination
foreign policy

territorial limits
defense
public health
international trade
space exploration
the aging
taxes
education
welfare reform
unemployment

- Are the lists of priorities for nations within each of the three categories quite similar? Explain.
- Are the differences between each of the three categories of nations markedly different? Explain.

Performance Indicators (Outcomes)

Natural resource policies come about as the result of interacting social processes: science and technology; government operations; private interests; and, public attitudes.

Have an understanding of the total interdependency of all the peoples and nations of the world upon one environment that is limited and often being despoiled by the industrial nations at the expense of other nations.

Procedures

Performance Indicators (Outcomes)

- Which nations seem to have interests which are quite different or in conflict with the interests of the United States?

Have the students develop an agenda for this "Forum of Nations" meeting which should attempt to achieve a reconciliation of divergent priorities and interests and develop global solutions to the problems raised.

Propose tentative solutions to conflicts created by divergent interests.

- What kind of a charter for global resource management can you all agree upon?

- What hope is there for the world's nations to recognize their interdependence, the finite nature of the globe, and the necessity for continued compromise?

10.] Consider the following equation:* $\frac{\text{RESOURCES}}{\text{POPULATION}} = $ *WELL-BEING. Discuss its meaning in general terms with the class. Then present to the group the list of statements below. For each one, have students use the incomplete phrasing of the equation which follows, supplying the appropriate words to make it reflect each condition stated:

> The value of RESOURCES (increases, decreases, remains the same) while the impact of POPULATION is (greater, less, unchanged), causing WELL-BEING to (improve, decline, remain the same).

> (It may be simpler to merely affix symbols [+], [-], [0] to the equation and place it after each statement.)

- Vast new petroleum and natural gas reserves are found.

- Solar energy becomes a practical fuel source.

- Birth control programs make great strides globally.

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*From: Living in the Environment - Concepts, Problems, and Alternatives by G. Tyler Miller, Jr., Wadsworth Publishing Co., 1974.

Procedures

Performance Indicators (Outcomes)

- Increased industrialization in developing countries increases per capita consumption of goods.

- The price of fertilizer skyrockets, but birth rates begin to decline with a decreased food supply.

- Ready reserves of petroleum become nearly depleted and the price of oil rises, lending fresh capital to exploration and discovery efforts.

- Increasing urbanization in developing countries raises standard of living conditions for millions.

- There is a catastrophic, though limited, nuclear war.

- Several alternative energy systems (geothermal, fusion) become practical.

You may wish to continue the list with any number of similar statements you and the students devise. Have students justify each application of the equation.

Resource

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UNIT 12: GOVERNMENT, POLITICS, AND THE ENVIRONMENT

Background:

A bumper sticker which reads "Environmentalists Pollute Our Economy" reflects an attitude and point of view which cannot be ignored by political leaders and public officials. The election of a legislator on an anti-environmental campaign stance is another sign of the political struggle in this vital area.

While volunteerism, public concern, and individual idealism have brought environmental action, legislation and court decisions have been the principal means of bringing change and remedy to some of the most serious abuses of our environment.

These historic changes have not come without opposition - not only from those economically concerned but from those politically and ideologically opposed as well. The bumper sticker represents a point of view that has become increasingly popular as the struggle for a safer, healthier environment has raged throughout the legislative halls of the Nation; as environmentalists slow or halt nuclear power plant construction during a time of energy shortages; and as ecological considerations impede developers' rush to create highways and tract housing. From the grass roots of local government through the United States Supreme Court, the environment has been politicized as pressure for change and reform builds up against the barriers of status quo, self-interest, vested interests, and deeply held values. Nor do the environmentalists have a monopoly on idealism. Self-interest and economic gain are often as compelling motives for them as they are for their opponents.

On the local level, the battle may be fought at the Zoning Board, the Sewage Waste Treatment Authority or the Planning Agency. Initially, the issue may surface as the result of efforts to establish such environmentally concerned agencies on the local level.

At the State or Federal levels, legislative or congressional committee hearings, budgeting and appropriation proposals, and regulatory agency mandates are constant battlefields for the environmentalists and those with differing points of view. Throughout all phases, from proposing through adjudicating, the struggle rages over these issues. The Federal courts have become referees and umpires as these issues move upon an already crowded legal stage.

Certain general arguments appear throughout these contests at any level. A few of those heard most frequently are: [1] If "we" (company, industry, governmental unit) are "forced" to adopt these measures (stop polluting), we will (a) leave the community and create unemployment or worse, (b) have to raise prices, (c) be forced out of business, (d) all of the above. [2] There is no conclusive proof that what "we" (same as #1) are doing is (a) polluting, (b) causing illness or death, (c) damaging the environment. [3] This is just another example of government interference in matters best left in private hands. [4] It is impossible to have both a dynamic economy and a safe, healthy environment. [5] If America is to achieve energy self-sufficiency, some concessions in terms of environmental preservation must be made in order to encourage energy development. [6] There are really no serious environmental problems or most of them have been greatly exaggerated. [7] Public funds spent on environmental programs could be much better spent on more pressing problems.

While sometimes overshadowed by more dramatic and sensational issues, the goal of environmentally sound policies and programs will continue to generate considerable controversy at every level of American government and politics, affecting the daily lives and actions of all.

General Understandings:

- Federal, state, and local governments have become involved in environmental questions and problems.
- Clashes between private interests and the common good have developed over environmental issues.
- Some environmental issues have resulted in the formation of special interest groups, lobbies, special agencies, public policy, and legislation regarding them.
- Individuals, companies, industry, and government tend to select short-term economic gains, often at the expense of greater long-term environmental benefits.
- It is the responsibility of each individual to become aware of existing governmental regulations intended to protect the environment. It is the responsibility of government to promulgate such regulations.
- Social, cultural, and political values and morals influence environmental attitudes. Humankind is continually developing and redefining the ethical base for making value judgments.

Procedures	Performance Indicators (Outcomes)
1.] Discuss with the class the definitions of "government." Have the students understand the major types of government and/or labels which apply to various forms of government (republic, democracy, dictatorship, monarchy, totalitarian, oligarchy, etc.)	Define government and politics.

Discuss the meaning of "politics."

- Which came first, government or politics? Explain.
- What is there about government that generates politics?
- How do politics affect government?
- Is environmental concern a governmental responsibility, a political issue, or both? Explain.
- What characteristics of the United States' form of government bode well for the resolution of environmental problems?
- Why are politics necessary?

Procedures

Performance Indicators (Outcomes)

- Cite references to the Constitution and other historical documents which support this contention?
- What features of our system of government and the economic system it protects have made environmental quality a goal difficult to achieve?

A frequent comment used to justify opposition to environmental improvement is, "I agree, but it doesn't seem feasible." In relation to this, exchange ideas with the class about the following quotations:

- "Some men see things as they are and say why? I dream of things that never were and say, why not?" George Bernard Shaw
- "The possible is irrelevant so it is only worth trying for the impossible." Robert Theobald

The following statements or definitions represent two characterizations of how politics may work, in common practice and ideally.

- common practice - When someone wins, someone must lose; if fortunes are reversed, someone else wins and someone else loses, and so on, until everyone has lost.
- ideally - Political goals should be to avoid strategies by which everyone loses ultimately and to devise strategies by which everyone may win.

Ask each student to select an environmental problem and write a brief description of the problem as a political issue handled in each of the modes described above.

2.] Review with students the constitutional definition of the executive branch's responsibilities. Then, refer them to Activity 8, Unit 5, Energy, Part II. This activity deals with the establishment of executive agencies to meet specific needs. Consider with the class the role of the Environmental Protection Agency.

Understand the responsibilities of the executive branch.

- What were the circumstances of its creation? By whom was it established and as a result of whose instigation?
- What is EPA's avowed purpose?

Procedures

- Summarize its accomplishments and its failings using copies of press clippings and magazine articles.
- Are there any cabinet-level departments whose responsibilities are overlapping, coincidental, or conflicting? If so, name them.
- Does the fact that state governments have similar agencies result in any conflict of responsibilities between the state governments and the Federal government?

Develop a partially completed chart similar to the example below. •Instruct students to name or describe the agency at each level, Federal, state, and local (county, city, town, village) which would deal with the problem stated at the left. Do not let the students worry unduly about jurisdiction, except in obvious instances, e.g., local vs. Federal. The object is to learn the names and responsibilities of government agencies at all levels.

Environmental Problem	Local agency	State agency	Federal agency
1. an oil spill in the Hudson River			
2. air pollution in New York City			
3. toxicity levels in Lake Erie			
4. toxicity levels in Lake Champlain			
5. exhaustion of landfill areas Queens			
6.			
7.			
8. (Continue the list with the class' help.)			
9.			
10.			

Performance Indicators
(Outcomes)

Evaluate the effectiveness of the EPA.

Procedures

Performance Indicators (Outcomes)

- Are the agencies named in the chart performing their responsibilities to the public's satisfaction? Explain. If they are not, what can be done to remedy the situation?

Ask each student to search recent newspapers and magazines in order to select a case study to report to the class. For each report, the student should consider:

- the issue
- agency involved
- the short- and long-range impact of the problem
- the cause of the problem and its possible solutions
- the public's welfare

3.] Instruct the class to develop a composite chart depicting the legislative enactments of the Federal Congress and the state legislatures. Have them begin with some of the 19th century laws dealing with hunting and fishing, through conservation legislation, and up to the most recent "environmental protection" laws. (Make sure that the landmark legislation is included: National Environmental Protection Act, Clean Air Act, New York's Tidal Wetlands Act, Hewitt Act of 1929, etc.)

Trace the historic pattern of some of the highlights in the development of conservation and environmental legislation.

Select, with the students, one of the pieces of legislation. Learn enough of the details of it so that the class may make a list of the roles involved. Some might include: legislator; lobbyist, interested citizens or group behind the legislation when it was proposed; various defendants in a case brought to court in connection with the new law—developer, outdoorsman, realtor, businessman, etc.

Assign roles among the students, with those remaining unoccupied becoming the legislature, and later, the jury or hearing panel.

4.] Environmental issues have given rise to a new area of emphasis in the legal profession..."environmental law." One of the greatest problems has been the difficulty in demonstrating that a wrongful act has been committed. However, the growing number of Federal and state laws regarding the environment has provided a wider basis for legal action.

Procedures

Instruct the class to research the emergence and development of environmental law, including reference to the applicability thereof of the general legal terms:

- standing
- jurisdiction
- substantive wrong
- class action

Ask the students to name some organizations which have filed environmental suits, identifying the environmental issue involved in each.

Assign a study task which will answer the following questions about the Environmental Defense Fund:

- How was it formed and by whom?

- Why was it created?

- What is its present purpose?

- Who supports the Fund?

As a case in point for this activity, provide the class with information about the 1965 Storm King Mountain case which involved the Scenic Hudson Preservation Conference and the Federal Power Commission. Discuss the case in terms of legal precedents dealing with the environment.

5.] Using area maps, have students locate major highways, population centers, power plants, waterways, railroads, sewer outfalls, water supplies and sanitary landfills. Once these strategic points have been located and identified, the potential environmental problems foreseen for these areas should be listed.

Ask the class to agree upon one potential problem as a priority which they will investigate by visiting and interviewing such officials as:

- water commissioner
- public health officials

Performance Indicators (Outcomes)

Trace the development of environmental law.

Procedures	Performance Indicators (Outcomes)
- commissioner of public safety - mayor - game warden	
For this problem (and others, if time permits), allow the students to discover what laws are already in existence concerning this problem and how these laws are, or would be, enforced.	
- What events or forces give impetus to current environmental laws?	
- How do various governmental agencies enforce environmental control laws? - How do agencies at different levels of government interact, or is that one of our problems? Explain.	Explain how environmental laws are enforced, citing recent examples in New York State.
- How do local governments finance environmental control programs?	
- How do local governments themselves contribute to environmental problems?	
6.] Have students devise a flowchart showing the divisions of responsibility at the local government level, underscoring the figures which represent officials and agencies expected to be responsive to environmental issues in the community. They should then indicate, with an overlay or a key, the relationship (direct or indirect) between the public and these officials and offices.	Chart local government responsibility for environmental issues.
- How responsive to the best public interest is local government? Explain.	
- How may public opinion be brought to bear (other than by voting) upon officialdom at the local level?	
Use the Categories of Environmental Problems, Issues and Concerns in the Appendix to provide students with a frame of reference for what they perceive to be local environmental problems. Divide the class into committees, assigning each committee one of the problems, asking each to outline a procedure it would use in an effort to form an environmental interest group within the community to deal with the problem. Discuss each committee's report in succeeding class sessions.	

- Once such committees are formed, how do these community interest groups get governmental action (legislative, executive) initiated?

- How would you, as a local government official, handle the problem(s)?

- Secure an example of local legislative proposals. Develop a similar proposal of your own to deal with the issue.

7.] Preparatory to having the students discuss what might constitute a workable, equable, and ethical "environmental bill of rights," reproduce the chart on the next page for their examination and study. Each column provides a list of "rights" (from: (a) the U.S. Bill of Rights; (b) Paul Ehrlich; and, (c) Arthur S. Boughey). The first is a list of rights guaranteed to us; the second is a suggestion of rights which read as a group of environmental objectives; while the third is a reflection of what our societal actions seem to indicate we take for granted as our rights.

Ask the students to match any of the rights between two columns or among the three columns for items which are in agreement and the items which are in direct opposition to each other.

Compare various interpretations of "bills of rights."

- Synthesize the ideal and most useful items from all three lists to assist you in preparing your own list of "environmental rights."

- Are any of the constitutional rights in conflict with environmental protection? Explain.

- Can a complete list of basic, human guarantees be developed from these lists? (Remember, those in the third column are presumed rights which abuse the environment and must be restated for use as characteristics of environmental stewardship.)

- What historical facts have led to the need for people to propose new lists of rights?

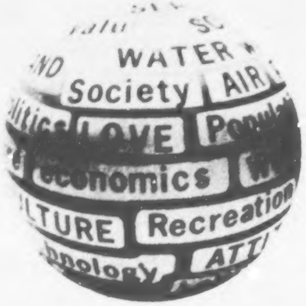
- How seriously should the items in the second and third columns be considered?

BILL OF RIGHTS OF THE U.S. CONSTITUTION

Freedom of religion.
Separation of church and state.
Freedom of speech.
Freedom of the press.
Freedom of assembly.
Freedom of petition.
Freedom to keep and bear arms.
Freedom from quartering soldiers in private homes in times of peace.
Freedom of persons and property from unreasonable search and seizure.
Search warrants to be issued only with good cause.
Indictment for crime only by a grand jury.
Freedom from double jeopardy.
Freedom from self-incrimination in criminal cases.
No person to be deprived of life, liberty, or property without due process of law.
Speedy, public trial in the district where the crime was committed.
Trial by jury in criminal cases or civil suits involving more than $20.
Right of the accused in criminal cases to be informed of the charges, to question witnesses, to call witnesses in his own behalf, and to have the assistance of counsel.
Freedom from excessive bail, fines, or cruel and unusual punishments.

"MANKIND'S INALIENABLE RIGHTS" (Paul Ehrlich)

The right to eat well.
The right to drink pure water.
The right to breathe clean air.
The right to decent, uncrowded shelter.
The right to enjoy natural beauty.
The right to avoid regimentation.
The right to avoid pesticide poisoning.
The right to freedom from thermonuclear war.
The right to limit families.
The right to educate our children.
The right to have grandchildren.



"DISPENSABLE" RIGHTS (Arthur S. Bouchey)

The right to have as many children as we wish.
The right to have any children at all by mates with particular genotypes.
The right to keep pets which consume food which could directly or indirectly be used for human purposes while populations and individuals elsewhere are stunted from malnutrition or dying from starvation.
The right to externalize our labor problems by strikes which dislocate societal facilities.
The right to reside in any locality of our own choice in these United States.
The right to accumulate wealth entirely disparate with basic needs while many elsewhere still cannot satisfy these, or transfer inherited wealth without reduction to an indefinite number of descendant generations.
The right to monopolize what would otherwise be community facilities.
The right to exploit national resources to the public detriment.
The right to possess lethal weapons.
The right to discharge wastes into the environment.

- (Each student) state a resolution which implies positive, environmental action but is in conflict with contemporary practice or assumption. Debate the wisdom of the resolution with your peers.

Consider with the students the advisability of having them add the composite of their individual lists of environmental rights as a fourth column and using the revised chart as a form of community survey. Tabulate the results of any such polling and modify the list of rights (the class') accordingly.

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UNIT 13: THE ENVIRONMENT AND CAREERS

Background

Generally speaking, the educational system is charged with the responsibility of meeting the post-secondary needs of all students. Thus, students need firsthand experiences which can be related to their own abilities, aptitudes, needs, interests, and values in order to make decisions about their lives after the completion of secondary school.

There is little doubt that the most meaningful and practical discussion of life and work goals occur in the context of the interest areas that are represented by individual disciplines. It is for this reason that a unit dealing with environmental careers finds its way into this syllabus.

A successful career decision on the part of an individual can be said to have been made when personal satisfaction, financial security, and peace of mind are realized. It is an added bonus when one has made a choice which is characterized by altruism as well. There is a great deal about concern for the environment which is unselfish, optimistic, and of benefit to many beyond oneself. For this reason, a career decision relating to the environment would be of singular value to the individual and to society and, therefore, rewarding enough to merit the scrutiny which is suggested by the procedures which follow.

General Understanding:

- Ethically, we are stewards of, rather than owners of, the environment; an environmental career is fulltime stewardship.

Procedures	Performance Indicators (Outcomes)
1.] Provide the class with a handout of the clusters of environmentally related careers on the next page. Ask each student to select, based upon interest, two occupations from the ones listed. Direct the students to research both of the selected careers and to present the following information about them to the class: • function and duties of the position • educational and/or skill requirements • availability of openings in this job area • opportunities for advancement • salary range • relationship of the career or job to the student's life goals • advantages and disadvantages of this position generally and as compared with non-environmental jobs	Recognize and describe the four basic "clusters" of environmentally-related careers.
2.] Prepare copies of the environmental issues categories found in the Appendix (p. 217) for distribution to the students. Instruct them to select environmental careers from the clusters on the next page,	Match environmental careers with environmental issues.

ENVIRONMENTAL CAREERS

I. CAREERS IN ENVIRONMENTAL SCIENCE AND RESEARCH

Life Scientists . . . .

General - Aquatic Biologist, Biochemist, Biophysicist, Biostatistician, Cytologist, Geneticist, Microbiologist, Pathologist; *Animal* - Animal Ecologist, Animal Husbandryman, Entomologist, Pharmacologist, Physiologist, Zoologist; *Plant* - Agriculturist, Agronomist, Botanist, Forest Ecologist, Horticulturist

Physical Scientists . . . .

Astronomer; Chemist - Analytical, Inorganic, Organic; Geologist - Assayer, Geodist, Geophysicist, Hydrographer, Metallurgist, Meterologist, Mineralogist; Oceanographer; Physicist; Seismologist; Soil Scientist

Social Scientists . . . .

Anthropologist, Economist, Geographer, Mathematician, Political Scientist, Psychologist, Sociologist, Statistician, Writer

II. CAREERS IN ENVIRONMENTAL EDUCATION AND TECHNOLOGY

Environmental Educators . . . .

Camp Counselor; Humanities Teacher; Life Sciences Teacher - Biology Teacher, Physiology Teacher; Physical Sciences Teacher - Chemistry Teacher, Geography Teacher, Geology Teacher, Physics Teacher; Public Health Educator; Social Sciences Teacher; Vocational Teacher

Environmental Engineer . . . .

Aeronautical; Agricultural; Chemical; Civil; Combustion; Electrical; Environmental; Geological; Hydraulic; Industrial; Industrial Safety; Mechanical; Mining; Nuclear

Environmental Health . . . .

Dietician and Nutritionist; Field Health Officer; Hygienist Physician; Sanitarian; Toxicologist

Environmental Planners . . . .

Architect; Landscape Architect; Urban Planner

Natural Resource Managers. . . . .

Fish and Game Warden; Forester; Oceanographer; Park Ranger - Naturalist; Range Manager; Soil Conservationist; Watershed Manager; Wildlife Manager

III. CAREERS IN ENVIRONMENTAL TECHNOLOGY AND IMPLEMENTATION

Inspectors or Monitors . . . .

Environmental Inspector, Food and Drug Inspector; Health Monitor; Nuclear Inspector

Technicians . . . .

Biological; Environmental; Food; Health; Horticultural; Land-Use; Nuclear; Physical Science; Resource Conservation

Testers or Analysts . . . .

Environmental; Mechanical

IV. CAREERS IN ENVIRONMENTAL APPLICATION AND OPERATION

Laborers - Attendants . . . .

Gardner; Incinerator Attendant; Janitor; Refuse Collector; Resource Developer; Wildlife Attendant

Operators and Foremen . . . .

Incinerator Foreman; Land-Fill Operator; Power Plant Operator; Recycling Operator; Water and Sewer System Foreman; Water Treatment Operator matching them with the environmental issues. The collective results obtained from Procedure 1.] should permit a fairly accurate assessment of the relationship between careers and issues. Discuss and refine the results of this exercise with the whole class.

Refer the students to the decisions they made in Unit 1 with regard to the relative seriousness of environmental problems.

- In general terms, how would you change your assessment of the seriousness of these problems in light of the units you have studied?
- Would your evaluation of the gravity of these issues influence your decision in selecting some environmental careers for further examination? Explain.
- Would you be interested in an environmental career? Why or why not? Has the study of these units contributed in any way to your decision?
- How would you rank an environmental career in relation to at least four other potential careers?

3.] Prepare overhead projection transparencies from Charts A and B on the following page.*

- What are the reasons for these rapid increases in environmental jobs during the period 1970-1975? (Chart A)
- Do you think that there will be similar growth from 1975-1980? Explain.
- Which of the clusters of jobs is likely to exhibit the greatest growth? Why?
- Which environmental pollution control area in Chart B will probably expand in terms of required jobs from 1975-1980? Explain your answer.

Evaluate an environmental career for yourself in relation to other possible careers.

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*From: Olympus Research. Career Education in the Environment.

Chart A

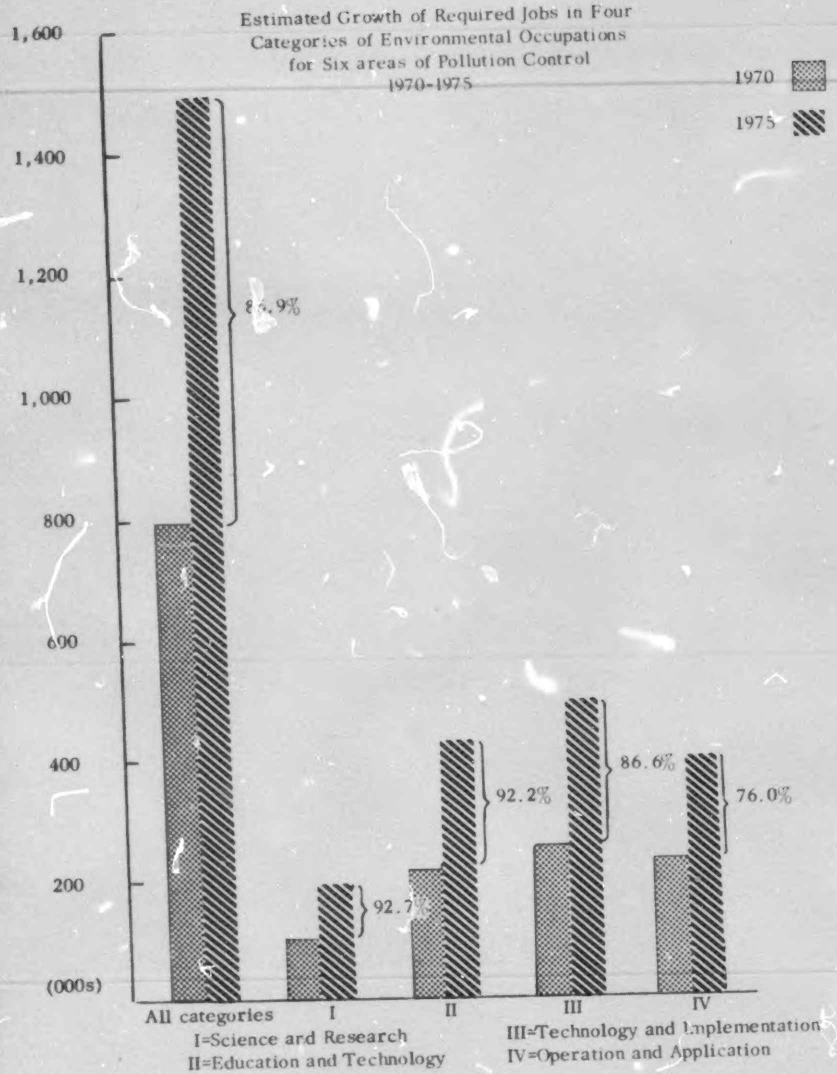
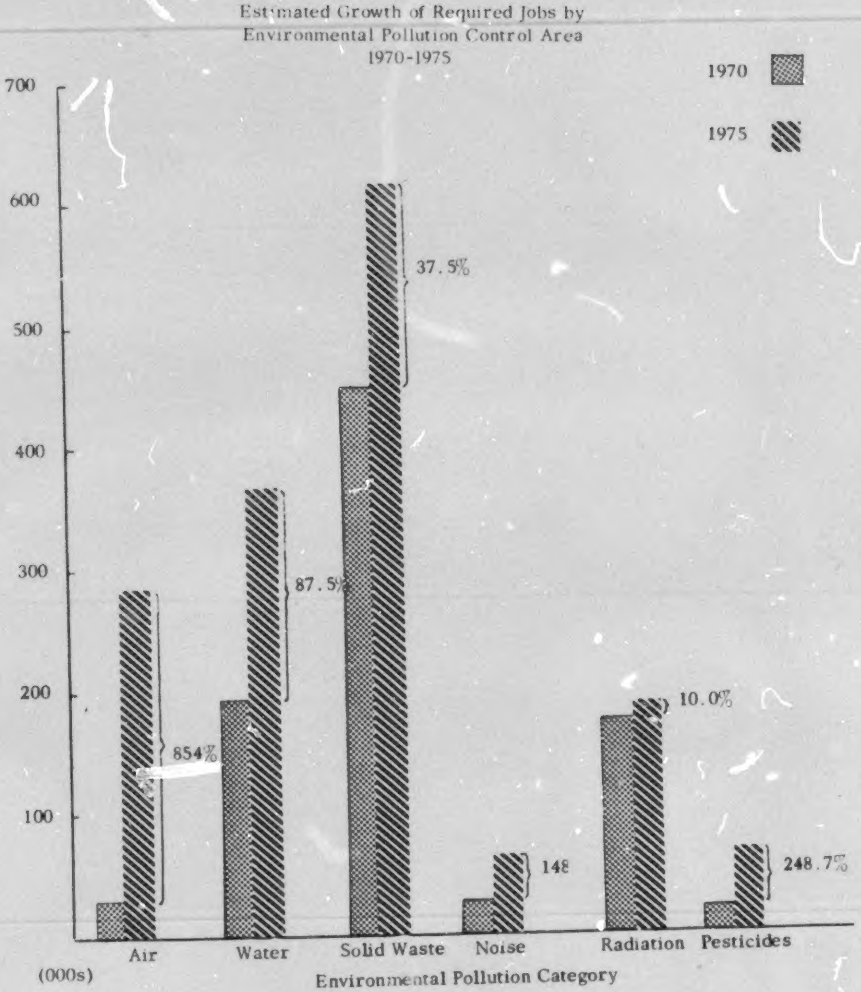

Estimated Growth of Required Jobs in Four Categories of Environmental Occupations for Six areas of Pollution Control 1970-1975

Chart B


Estimated Growth of Required Jobs by Environmental Pollution Control Area 1970-1975

Procedures	Performance Indicators (Outcomes)
4.] Distribute to the students copies of the Environmental Protection Agency's Environmental News on page 189. • Which New York State agencies would be involved in these proposed, cooperative programs? • Try to describe what a typical program offered might be like by writing a brief course description related to a specific environmental job/career area. • Cite at least two Federal and two State laws which have created environmental career opportunities and name the careers.	
5.] The class should create a Speakers' Bureau comprised of local resource persons who would be available to speak to student groups seeking career information. Environmental careers would be one of the principal topics for which speakers would be listed. Teachers in the school should be asked to serve as moderators during career presentations related to their respective teaching disciplines.	Contact local resource people with the object of having them contribute to the school program. Prepare an informational handout relating to a school activity.
A member of the class might become chairperson of each career area committee which would draw its participation from students in other classes. The committee responsibilities would include: enlisting the appropriate resource person for each speaking engagement; preparing publicity for each presentation; and, recording the highpoints of the presentation for development of a summary.	Summarize the highlights of a speech or oral presentation and record the prominent points of subsequent discussion.

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Environmental News

FOR IMMEDIATE RELEASE FRIDAY, OCTOBER 8, 1976

EPA-OFFICE OF EDUCATION TO FOCUS ON ENVIRONMENTAL JOBS

The Office of Education and the U.S. Environmental Protection Agency have signed a memorandum of agreement to stimulate mutual programs between State educational and environmental agencies. These programs would train persons in environmental occupations and enhance environmental career opportunities.

The agreement establishes a formal cooperative relationship for information exchange and interagency activities. Adoption of similar arrangements among State and local counterpart agencies, the agencies feel, would help to ensure an adequate supply of qualified personnel engaged in environmental quality management and control. Cooperative programs will involve training and education at both professional and subprofessional levels.

Federal and State legislation regarding air and water pollution, water supply, solid waste, radiation, pesticides, and noise control have created many new career opportunities.

UNIT 14: SUMMARY

Background

The introductory statement for Unit 1, The Environmental Status Quo, included the question "Where are we in this environmental crisis?" We must now ask ourselves, "Where are we going, environmentally speaking? What will our environment be like in twenty-five years, or one hundred years, or two hundred years? Can we be optimistic or must we expect a series of environmental crises? How long will humans persist in their attempts to subdue this plundered planet? When will the Western concept, 'Man against nature,' be rejected by our civilization"?

*Let us consider, in terms of current trends, some of the major predictions futurists have made:

- an increasing number of "Third World" citizens and a proportionately decreasing number of westerners
- smaller concentrations of young Americans and larger colonies of old ones
- a drop in working hours
- a rise in the political power of women and ethnic minorities
- an expansion of leisure time
- a diminishing of traditional food and fuel supplies
- an increase in life span
- more danger of military conflict
- an increase in the dangers of ecological mismanagement

*(Time May 17, 1976)

Although there are these dire predictions for our environment, let us remember that futurists merely prophesy, while we humans actually direct the course of events. It is imperative that we give lie to a number of these prophecies.

General Understandings

- Given these present and future conditions, and with environmental education as the tool, it is essential that we should:

  -examine the dynamics of population
    —Are we considering all of the effects of, and the alternatives to, our present rates of economic and population growth?

  -plan more wisely so as to limit the degree to which we disrupt ecosystems

  -consider the gap between the "haves" and the "have nots"
    —Does the United States unwittingly establish unattainable standards (economic, etc.) which other nations must of necessity emulate to an increasing degree of frustration?

  -reorganize our institutions and resources to deal with the causes of environmental problems rather than ineffectually grappling with their symptoms

  -educate society to act less precipitously and with more concern for consequences

-recognize that values are, to a degree, culturally prescribed and may thus be culturally revised

-realize that the knowledge, skills, and attitudes we purvey in most of our classrooms relate to our natural and manmade surroundings and bear a significant relationship to the problems we perceive in our environment

- The environmental crisis is a crisis of human values.
- The waste of natural resources can limit the options available to future generations.
- We have the ability to make this the best of all possible worlds.

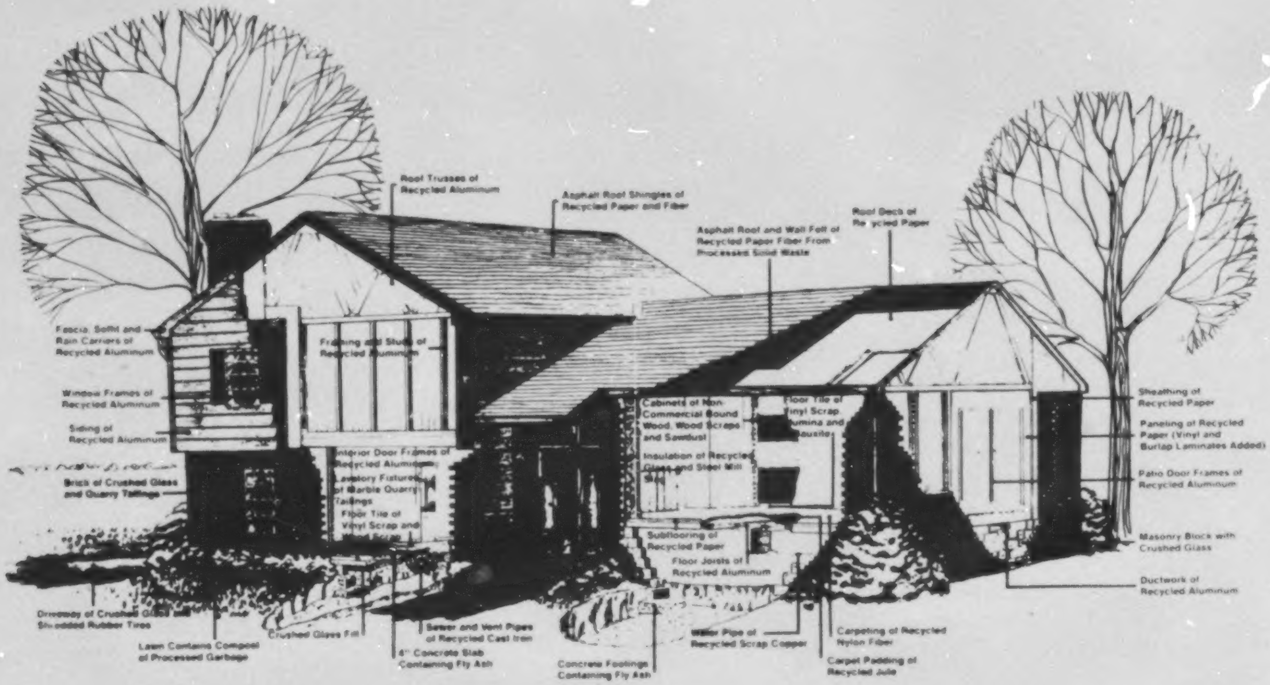
Procedures	Performance Indicators (Outcomes)
1.] Summary. Organize the students into a number of groups equal to the number of units selected and used during the duration of the course. Have each group develop an outline of its assigned unit from which a spokesman may present a 10-minute review of the unit to the whole class. Any handouts, transparencies or other visual materials will enhance the presentation. Require the class to take notes on this unit-by-unit review.	Review in sufficient detail and organization all of those units selected to comprise the environmental studies program.
When the summary has been completed, provide each student with a complete set of outlines for the units studied and inform them that a final examination will be administered at the conclusion of this unit on the objectives, concepts, skills, and facts of the course.	Write in outline form the many concepts and important terms of each unit studied in the program.
2.] An Environmental Ethic Revisited. As in Unit 1, ask each student to write an environmental ethic, including the seven criteria cited in that activity (p. 9). Then, ask each pupil to respond to the following: • Redo Procedure 1, Unit 1, comparing any changes in problem priorities. • How is your assessment of the status of the 12 environmental concerns (cited in activity 2, Unit 1, p. 6) different? • Have you changed your definition of a "right" and of a "responsibility"? • Did you list any new "environmental rights" this time? • Did you list any new "environmental responsibilities" this time?	Redistinguish between a right and a responsibility and cite seven examples of each as applied to the environment.

Procedures	Performance Indicators (Outcomes)
• How did your personal assessment of the worth or value of the natural environment change? • Contrast your statements on the importance of our modern, technological way of life. • What is your prediction of a solution to the environmental crisis now?	
3.] Given the idea that a simulation is an imitation or simplification of some aspect of reality, consider a simulation game which devolves on the premise of some "alternatives to Spaceship Earth." If we do in fact proceed to completely plunder our planet, what are the options for civilization?	Simulate potentially real world issues and situations which involve "futuring."
Divide the class into two groups. One group will construct a hypothetical situation in which the direst predictions of the critics of our lifestyle have come to pass... and then develop a blueprint for survival given these extreme conditions: poisoned air; befouled water; breakdown in major energy systems; disruption of food chains; depletion of resources.	Identify at least five major environmental problems, issues, or crises which threaten the existence of humans on earth. Role play, departing from traditional, known roles, assuming characters and activities in situations as yet not experienced.
The other group will take these dire predictions one step further... the given is that the planet earth is clearly to become uninhabitable within a relatively short time and the solution to survival is to be an extraterrestrial one. Have the students use this simulation as an opportunity to create a chart of the relative characteristics of the other planets in our solar system. (A chart of this type is provided for teacher reference in the Appendix on p. 216.)	Identify and characterize other planets in the solar system. Determine the minimum, other-planetary compatibility with earth characteristics.
Students should develop these simulations as scenarios, being realistic, however, in terms of using and extrapolating from known data and statistical projections. Each simulation should culminate in a presentation of a scripted debate, panel offering, or report which reflects the data gathered, the solutions proposed, and the resolution of these into a course of action.	Weigh and resolve situations which are not yet, or might never be, part of the human experience.

Procedures

4.] Assign a small group of interested students the project of designing the "house of the future." As architects working on construction planned for A.D. 2100, they must be concerned with the scarcity, and in some cases the unavailability, of many resources currently used. Also, future lifestyles must be considered. Begin discussion on the subject by referring to the illustration on this page.

To stimulate student imagination, the teacher might suggest that the walls of the house be constructed from a mixture of recycled paper with plastics and sand (70% paper, 20% plastics, 10% sand). It might also be suggested that the floors be constructed of a material including recycled glass with sawdust (90% glass, 10% sawdust).


Roof Trusses of Recycled Aluminum
Asphalt Roof Shingles of Recycled Paper and Fiber
Asphalt Roof and Wall Felt of Recycled Paper Fiber From Processed Solid Waste
Roof Deck of Recycled Paper
Fascia, Soffit and Rain Carriers of Recycled Aluminum
Framing and Studs of Recycled Aluminum
Window Frames of Recycled Aluminum
Siding of Recycled Aluminum
Interior Door Frames of Recycled Aluminum
Lavatory Fixtures of Marble Quarry Tailings
Floor Tile of Vinyl Scrap and
Brick of Crushed Glass and Quarry Tailings
Cabinets of Non-Commercial Bound Wood, Wood Scraps and Sawdust
Insulation of Recycled Glass and Steel Mill Slag
Floor Tile of Vinyl Scrap, Alumina and Bauxite
Subflooring of Recycled Paper
Floor Joists of Recycled Aluminum
Sheathing of Recycled Paper
Paneling of Recycled Paper (Vinyl and Burlap Laminates Added)
Patio Door Frames of Recycled Aluminum
Masonry Block with Crushed Glass
Ductwork of Recycled Aluminum
Driveway of Crushed Glass and Shredded Rubber Tires
Lawn Contains Compost of Processed Garbage
Crushed Glass Fill
Sewer and Vent Pipes of Recycled Cast Iron
4" Concrete Slab Containing Fly Ash
Concrete Footings Containing Fly Ash
Water Pipe of Recycled Scrap Copper
Carpeting of Recycled Nylon Fiber
Carpet Padding of Recycled Jute

The crushed glass used in the house was enough to produce 124,000 average 12-oz. non-returnable beverage containers. Recycled newspapers weighed 8.5 tons. Fly ash in the concrete collected by air pollution control equipment at a coal-burning electric plant was equivalent to 18 tons of coal needed to produce 41,000 kilowatt-hours of electricity. New York City garbage was processed by Ecology, Inc. and used as compost for the yard.

Photos courtesy of Reynolds Metals Co.

Workers put down subflooring material made of processed waste paper.

Procedures

Performance Indicators
(Outcomes)

Use the suggested questions below to plan the first phase of the activity. Encourage creativity and imagination!

- List all construction materials. What new (recycled) materials will be used for the frame, roof, floors, windows, walls, ceilings, and doors? How will they be manufactured?

- Design the heating and cooling system. What new (recycled) materials will be used? How can the system be made extremely compact? Pay special attention to insulation.

- Describe and design samples of home furnishings including: chairs, tables, beds, and others. What new styles can be introduced to make use of recycled materials?

For the second phase of the project, have students prepare scale drawings of floor plans for the "house of the future" as described above. (It might be advantageous to have the students use the metric system for all measurements.)

As a possible third phase of the project, students might be asked to do research on new sources and methods of providing the house with energy for heating and operating mechanical devices. The following possibilities might be investigated:

Describe alternative residential energy sources.

-solar energy satellites
-geothermal power
-wind and tidal power
-solar furnaces

5.] Ask the students to study a copy of the sample collection of headlines found on page 195.

- What do they indicate? Are they positive or negative, environmentally speaking?

- Were they all taken from the same sources? What sources would you use?

- For how long a period of time do you think were they collected?

+ *Game fish return to Lake Erie*

+ Monsanto Will Stop Making PCBs

- **Barge Spills Oil In St. Lawrence**

+ State Acts to Control Use of Fluorocarbons

- Cancer: Mostly a Disease of the Environment

+ **Researchers Investigate Ways To Remove PCBs from Sediment**

- *Barge Rams Bridge, Spills Oil into Hudson*

- **New York Forests Change With Loss of Beech Trees**

- **Long Island Beaches Inundated by Debris**

+ **Improvement in protection of wildlife cited**

+ City Tries to Prevent Radioactive Shipment

+ **Legislation Extends Wildlife Protection**

+ *Union Chief Says SSTs Are Unsafe*

+ **Air Force To Modify Flights**

Procedures	Performance Indicators (Outcomes)
Direct each student to collect headlines pertaining to the environment in some way and to prepare an interesting collage of this material. Using at least three newspapers and/or magazines, collect the headlines for a period of one week. (The sample provided represents a month's collecting.)	Prepare an effective collage consisting of at least 10 items.

As each headline is acquired, the student should read the associated article to ascertain whether it is a positive or negative news item, and label the headline "+" or "-". When all the headlines have been assembled, they should assess the week as generally "good" or "bad" for the environment.

- If this activity were continued for a year, do you think the net assessment would be positive or negative?
- Review the titles of the previous thirteen units. Look at the headlines again. Match each headline with the title it relates to.
- Are you an optimist or a pessimist regarding the future of our environment? Explain.
- Do newspapers and magazines accurately and effectively report the continually changing environmental condition? How about other types of media? Discuss.

6.] The hope for our future and the future of our environment rests with people and with society's institutions. Consider the following categories:

- Individual citizen
- Private citizen groups and organizations
- Educational institutions
- Private industry and business
- Local town, county, or city government
- Regional governmental institutions
- State Government
- Federal Government
- United Nations

Procedures

Through class discussion, identify from the phrases above those most responsible for the ultimate (if possible) solution to each of the following environmental problems:

- Chemical, Biological and Radiological Contamination
- Destruction of Natural Environments
- Energy Shortage
- False and deceptive advertising, product information
- Land Abuse
- Life Styles
  - -Economic demands and necessities
  - -Social structure and needs
  - -Cultural requirements
- Loss of renewable and nonrenewable resources
- Overpopulation
- Pollution
  - -Air
  - -Effects on human health
  - -Water
  - -Noise
  - -Visual/aesthetic
- Solid Waste
- Transportation/congestion

Consider with the class the following questions:

- How often was the individual citizen adjudged "most responsible" for the solution to a problem?

- Which category was most frequently cited as "most responsible"?

Ask the students to reflect upon their current lifestyles. For each problem mentioned as associated with the "individual citizen," ask the students to predict how their future attitudes, opinions, beliefs, and activities will help to bring about a solution, or, at least, an improvement.

Performance Indicators (Outcomes)

List at least five categories of people responsible for the ultimate solution of environmental issues.

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Procedures

Performance Indicators
(Outcomes)

7.] Provide each pupil with a copy of the following reading. Discuss the work with the class.

"In the end, there was the Earth, and it was with form and beauty. And man dwelt upon the lands of the Earth, and he said, 'Let us build our dwellings in this land of beauty.' And he built cities and covered the Earth with concrete and steel. And the meadows and the trees were gone and man said, 'It is good.'

"On the second day, man looked upon the waters of the Earth and man said, 'Let us put our waste in our waters and the dirt will be washed away.' And man did. And the waters, the rivers and the lakes, became polluted and foul in their color and smell. And man said, 'It is good.'

"On the third day, man looked upon the forests of the Earth and saw that they were beautiful. And man said, 'Let us cut the timber for our homes and grind the wood for our use.' And man did. And the lands became barren and the trees were gone. And man said, 'It is good.'

"On the fourth day, man saw that the animals were in abundance and ran in the field and played in the sun. And man said, 'Let us cage these animals for our abundance and kill them for our sport.' And man did. And there were no more animals on the face of the earth. And man said, 'It is good.'

"On the fifth day, man breathed the air of the Earth. And man said, 'Let us dispose of our wastes in the air for the winds shall blow them away.' And man did. And the air became heavy with smoke and dust. The sun could not be seen and the winters became long and cold. And man said, 'It is good.'

"On the sixth day, man saw himself, and seeing the many peoples, their languages, their cultures and their colors, he feared and hated. And man said, 'Let us build great machines and bombs, and the Earth was fired with the rage of great wars. And man said, 'It is good.' (Anon.)

Procedures

Performance Indicators (Outcomes)

"On the seventh day, man rested from his labors and the Earth was still, for man no longer dwelt upon the Earth. And it was good."

- What is this type of writing called?

- Are there parallels between the sections of this prose and the environmental course you have just completed? Enumerate them.

- Characterize each of the paragraphs in this writing by matching it with the most appropriate category of environmental issues (which are represented in Procedure 6, and which are also found in the Appendix) by underlining the telltale phrase and writing in the name of the issue category in the margin.

- This is a very pessimistic statement for our environment and world. Organize the students in groups of three to revise this passage so that it is a more optimistic statement of our environmental future.

Write a brief essay about the future of the environment.

8.] Re-administer the Knowledge Inventory (Appendix, p. 201) which was used in Unit 1. The items, keyed as they are to Units 2-12, are designed to provide a measure of the students' knowledge of environmental issues and information now that they have completed the course. The results should be considered as an indication of the Units' effectiveness and not as a student performance evaluation per se. This latter objective should be achieved through a course exam of your own making.

Resources

"Blueprint for Survival," The Ecologist, vol. 2, no. 1, 1972. [3.]

Environmental Protection Agency. Toward a New Environmental Ethic. Washington: Government Printing Office. [2.]

Falk, Richard A. This Endangered Planet: Prospects and Proposals for Human Survival. New York: Random House, 1971. [5.]

Futurity. Game. Cambridge, MA: Alt Associates. [3.]

Resources

"Mars: The Riddle of the Red Planet," *Time*, August 2, 1976. [3.]

Technology Review. *Energy Technology in the Year 2000*. Cambridge, MA: Technology Review, 1972. [3.]

Toffler, Alvin. *Future Shock*. New York: Random House, 1970.

Tugwell, Guy R. "Shaping the Constitution for the year 2000," in Harvey S. Perloff, ed., *The Future of the U.S. Government: Toward the year 2000*. New York: Braziller, 1971. [6.]

THE MOON IS A NICE PLACE TO VISIT BUT I WOULDN'T WANT TO LIVE HERE...

APPENDIX - KNOWLEDGE INVENTORY

Directions: Circle the number of the word or phrase which best answers the question or completes the statement.

Unit

1. If a "population" is the term for a group of organisms all of the same kind, what is the term for several populations grouped together? 2

   1 biosphere
   2 organization
   3 community
   4 lithosphere

2. Which is the source of most of the world's oxygen? 2

   1 trees and other forest plants
   2 natural grasslands and farm pastures
   3 tiny plants (phytoplankton) near the surfaces of oceans
   4 plants growing at the bottom of the oceans

3. Of the following nutrients, which one must be available in greater quantity if dietary deficiencies are to be corrected in developing nations? 3

   1 fats
   2 minerals
   3 proteins
   4 carbohydrates

Unit

4. Approximately what percent of the energy at one level of a food chain moves to the next higher level? (e.g., corn → beef cattle → human protein) 3

   1 10%
   2 20%
   3 30%
   4 40%

5. The "birth-rate solution" to the human population problem is to 4

   1 allow natural disasters to limit population
   2 improve hospital facilities so all nations have the same rate of infant mortality
   3 take steps to reduce the number of babies born
   4 increase the production of food so that food supply growth equals birth rate growth

6. What is the most serious reason why population growth in developing nations is a problem? 4

   1 Food resources are growing at a slower rate than the population.
   2 The nations are running out of room.
   3 Political revolutions result from poverty.
   4 Increased population leads to increased pollution.

Unit

7. A standard unit of heat energy is a 5-(I)

   1 thermometer
   2 kilowatt
   3 BTU
   4 Celsius

8. Which of the following equivalents is incorrect? 5-(I)

   1 1 pound = 2.2 kilograms
   2 39.37 in. = 1 meter
   3 1 kilogram = 9.8 newtons
   4 746 watts = 1 horsepower

9. In terms of energy conversion, which one of the following is most efficient? 5-(II)

   1 internal combustion engine
   2 large electric motor
   3 light bulb
   4 steam power plant

10. All the following are fossil fuels except 5-(II)

   1 natural gas
   2 solar energy
   3 oil
   4 coal

11. All of the following are, or can be, examples of good land use practices except 6

   1 Housing and Urban Development Act of 1970
   2 zoning ordinances
   3 tidewater marsh landfills
   4 conducting a land use feasibility study

Unit

12. A technological advance which has least influenced the use of land in this state is 6

   1 modern methods of highway construction
   2 nuclear power plant
   3 jet aircraft
   4 improved building materials for home construction

13. To an environmentalist, which is the least desirable effect of the Interstate Highway System?

   1 Good roads produce a desire for more privately-owned automobiles. 7
   2 Building the roads produces more jobs, at least temporarily.
   3 The roads permit easy travel from place to place.
   4 Using gasoline taxes to finance the construction discriminates against the individual motorist.

14. A senator who is concerned with the environment would most likely support a bill to 7

   1 develop large transport airplanes
   2 improve the efficiency of long-distance railroad transportation
   3 prohibit a long-distance truck to tow more than one trailer at a time
   4 add to the existing Interstate Highway System

Unit

15. The products of American agriculture are subject to great price fluctuations because of: 8

1 lack of diversity in planting by the individual farmer
2 great variations in consumer demands
3 insufficient use of fertilizers
4 poor soils

16. Diesel engines are frequently suggested as a means of alleviating certain aspects of the energy crisis. Which one of the following statements about diesel engines is *not* true: 8

1 given equal horsepower ratings, they afford better fuel economy than gasoline engines
2 the fuel is cheaper to produce
3 the fuel contains more energy per gallon
4 diesel engines produce fewer emissions of all types

17. Of the following insecticides formerly or presently in use, which one is considered the most dangerous to life in general? 9

1 pyrethium
2 rotenone
3 chlordane
4 sevin

Unit

18. The amount of human fecal contamination in water is most frequently measured by: 9

1 a physical examination of fish
2 the weight of fecal particles
3 the use of an indicator bacterium
4 odor

19. Which of the following *does not* characterize the nature of typical advertising appeals designed to stimulate artificial "needs" and promote consumer purchasing? 10

1 emotional
2 scatological
3 psychological
4 testimonial

20. All of the following phrases suggest the possibility of consumer and environmental benefits *except*: 10

1 "caveat emptor"
2 truth in packaging
3 planned obsolescence
4 unit pricing

21. It is incredible but true that the United States, with merely six percent of the world's population, produces nearly 50 percent of the world's pollution while consuming approximately _____ of the world's resources. 11

1 one-tenth
2 one-fifth
3 one-third
4 one-half

Unit

22. Which one of the following is probably the best goal an underdeveloped nation can hope to achieve during the next decade? 11

    1 energy independence
    2 a favorable balance of trade
    3 a Western (developed nation) lifestyle
    4 protein sufficiency for all its citizens

23. Which one of the following is most concerned with achieving the goal of energy independence in the United States? 12

    1 ERDA
    2 EPA
    3 OPEC
    4 COMECON

24. At the local level, which one of the following officials would be the most effective in resolving a community water pollution problem? 12

    1 public safety commissioner
    2 chairman of the zoning board
    3 water commissioner
    4 mayor

KNOWLEDGE INVENTORY - KEY

1.	3	13.	1
2.	3	14.	2
3.	3	15.	1
4.	1	16.	4
5.	3	17.	3
6.	1	18.	3
7.	3	19.	2
8.	1	20.	3
9.	2	21.	3
10.	2	22.	4
11.	3	23.	1
12.	4	24.	4

APPENDIX - CASE STUDIES

CASE STUDY I - "Let's Not Fritter Fertilizer"

Schery, Robert W. "Let's Not Fritter Fertilizer," American Horticulturist, Late Spring, 1975.

- What views does Dr. Schery seem to express on the following?

  (a) World Population Pressures
  (b) Food Production
  (c) Fertilizer Used for Non-food Purposes
  (d) Problems of Developing Nations

- Research the statistics on the quantity of fertilizer used for home lawn and garden purposes.

- Does the author too readily dismiss this? Explain.

- How do the views of the author of this article contrast with those of OXFAM and other concerned groups?

- As Secretary of the Department of Agriculture in a developing nation, how might you react to this article?

- Write an editorial which either agrees with Dr. Schery's viewpoint or disputes his contentions.

- Make a collection of political cartoons (drawn by class members) which supports or refutes Dr. Schery.

CASE STUDY II - Interpreting Environmental Cartoons

"The Population Institute's Cartoon Contest Winners," Sierra Club Bulletin, June, 1976, pp. 28-31.

- Explain each of the cartoons and the point of view suggested by each.

- What does the third-prize cartoon indicate about growth rates?

- Who were the ancient four horesmen (second prize)?

- What does the cartoonist in the Magazine Category Award believe about family planning? Do you think this cartoon supports governmental action or voluntary compliance?

- While the third-prize cartoonist may be ignoring some principles of physics, he clearly expresses what opinions?

- How might a catastrophic war affect the rate of consumption of finite resources (Comic Strip Panel Category Award)?

CASE STUDY III - "Jobs - Not Fish (...Not Clean Air; ...Not Clean Water)"

While they deal with different areas and localized issues, the three readings cited for this study pertain to the common problem of the economy versus the environment. Students should read the articles noted at the end of this unit and respond to the following questions in the manner suggested at the outset of Procedure 6, Unit 1, page 10.

- To what extent may the Federal government become involved in these problems when they seem to be clearly State and/or local matters?
- What is the role of the Federal judiciary?
- What is a class action suit?
- Assume a position on one side of the controversy. Develop arguments to support your position.
- As the mayor in any one of these cities or areas, what steps would you take to insure that these industries would not leave your community and take their jobs with them?
- What is meant by the statement that in Ohio, we are seeing "the beginning of the second phase of air pollution for the country as a whole?"

Farrell, William E. "Long Reserve Mining Dispute Is Far From Resolved," New York Times, Tuesday, February 10, 1976.

Rattner, Steven. "Jobs - Not Fish - Wins in Ohio Steel Town," New York Times, Monday, April 5, 1976.

Stevens, William K. "Ohio Is Crucial Testing Ground in U.S. Pollution Fight," New York Times, Tuesday, February 10, 1976.

CASE STUDY IV - "Breaking the Web"

- Explain the categorization of animals according to their extinction status.
- Why is 1600 a key date in studying endangered species?
- Speculate as to why endangerment or extinction of species has become more the result of indirect rather than direct causes or factors in recent times.
- Explain the theories of "overkill," "overchill," and "coup de grace."

Uetz, George, and Donald L. Johnson. "Breaking the Web," Ecology, December, 1974.

- Why have bird species been affected to the greatest degree in all categories?

- Considering the great commercial value of fish, why is it that this animal group is the least threatened (TABLE I)?

- How and why has hunting altered in modern times in terms of its impact upon species survival?

- Select a recently extinct species or a critically endangered one and write a summary of the circumstances responsible.

- Discuss the pet trade.

- Describe the role of zoos in species preservation and the limitations inherent in the pratice.

- Sketch out the opposing arguments of species preservation versus the inevitability of species extinction and evolutionary change. Debate the issue.

CASE STUDY V - "The Forgotten Energy Crisis"

Ullman, Al. "The Forgotten Energy Crisis," Sierra Club Bulletin, no. 33, 1976.

- What is Congressman Ullman's main concern as expressed in the beginning of this article?

- Who is to blame for our energy predicament?

- What has the Federal government done about the energy crisis?

- What suggestions are offered as remedies to the problem?

- How should responsibility for solving the problem be shared, according to the author?

APPENDIX - ENERGY USE CHART

Appliance	Average Wattage	Annual (Typical) Energy Consumption (Kilowatt-hours)	Estimated Use (in Kilowatt-hours)	Annual Cost of Energy Consumed*
Air Cleaner	50	216		$ 6.48
Air Conditioner (room)	1,600	1,500	1 1/2 per hour	45.00
Blender	386	12	1/50 per hour	.36
Broiler	1,500	96		2.88
Can Opener	100	0.3		.01
Carving knife	92	0.8	1/100 per carving	.02
Clock	2	18	1 1/2 per month	.54
Clothes dryer	4,865	1,000	3 per load	30.00
Coffee Maker	894	108	1/4 per pot	3.24
Deep Fryer	1,448	84	1 1/2 per hour	2.52 2.52
Dehumidifier	257	384		11.52
Dishwasher	1,201	360	1 per load	10.80
Egg cooker	516	12		.36
Fan (attic)	370	288	1/4 per hour	8.64
Fan (circulating	88	36	1/10 per hour	1.08
Fan (furnace)	270	576		$ 17.28
Fan (window)	171	132	1/5 per hour	3.96
Floor-polisher	305	12	1/3 per hour	.36
Freezer (15 cu. ft.	341	1,200	3 per day	36.00
Freezer (frostless 15 cu. ft.)	440	1,764	5 per day	52.92
Frying pan	1,196	192	1 per day	5.76
Hair dryer	381	12	1/3 per hour	.36
Heat pump system	10,000	15,360		460.80
Heating pad	65	12		.36
Hot plate	1,257	90		2.70
House heat (electric)	—per 1000 sq. ft.—	15,000		450.00
Humidifier	177	168	2/3 per day	5.04
Iron (hand)	1,008	144	1 per hour	4.32
Lighting		960		28.00
Mixer	127	12	1/20 per operation	.36

APPENDIX - ENERGY USE CHART

Appliance	Average Wattage	Annual (Typical) Energy Consumption (Kilowatt-hours)	Estimated Use (in Kilowatt-hours)	Annual Cost of Energy Consumed*
Oven (microwave)	1,450	192		$ 5.76
Radio	71	84		2.52
Radio-Phonograph	109	108		3.24
Range (with oven)	12,200	1,176	1 1/2 per meal (surface)	35.28
Range (with self-cleaning oven)	12,200	1,200	1/2 per hour (oven) 6 per cleaning	36.00
Refrigerator (14 cu. ft.)	326	1,140	3 per day	34.20
Referigerator (frostless, 14 cu. ft.)	615	1,824	5 per day	54.72
Roaster	1,333	204		6.12
Sandwich grill	1,161	3		.09
Sewing machine	75	12	1/50 per day	.36
Shaver	14	1.8	1/1000 per shave	.05
Sun lamp	279	12		.36
Television: BW-tube	160	348		10.44
Television: Color-tube	300	660		19.80
Television: BW-solid state	55	120	1/4 per hour	$ 3.60
Television: Color-solid state	200	444	1/3 per hour	13.32
Toaster	1,200	36	1/20 per slice	1.08
Toothbrush	7	.5	1/1000 per brushing	.02
Trash compactor	400	48		1.44
Vacuum cleaner	630	48	2/3 per hour	1.44
Waffle iron	1,116	24	1/4 per waffle	.72
Washing machine	512	102	1/3 per load	3.06
Waste disposer	445	30	1/100 per load	.90
Water heater (elec.-standard)	2,475	4,224	12 per day	246.72
Water heater (quick recovery-elec.)	4,474	4,812	14 per day	144.36
Water pump (well)	450	204	1 per day	6.12

*Cost of electricity = 3 cents per kilowatt-hour.

LAND USE AND ZONING: PETALUMA, CA

```
PRINT ABSTRACTS=A//#       NEXT=B OR B//#          END INQUIRY=C
(C)NYTIMES. SEE ABSTRACT FOR YEAR. NONTIMES MATERIAL BY PERMISSION
   6 OF    15 NYT/JNL 1974- 4-30     :     50:  3 4/WGT   5/LIN
   120-74-16 AP /SRC                       619137/IDN
FED DIST CT JUDGE LLOYD H BURKE SAYS CITY OF PETALUMA, CALIF,
HAS NO RIGHT TO IMPOSE LIMITS ON ITS ANNUAL POPULATION GROWTH
AND GRANTS DECLARATORY JUDGMENT TO DEVELOPERS WHO HAD
CHALLENGED CITY'S '72 ORDINANCE THAT LIMITED GROWTH TO 500 NEW
HOUSES PER YR OVER 5-YR PERIOD

  10 OF    15 WSJ/JNL 1975- 8-14     :      9:  2 4/WGT   4/LIN
   460-20- 5                              1027282/IDN
FED APPEALS CT REVERSES US DIST JUDGE L J BURKE'S DECISION;
RULES PETALUMA, CALIF'S ZONING PLAN THAT LIMITS NEW HOMEBLDG
PERMITS TO 500 PER YR FOR 5 YRS DOES NOT VIOLATE CONSTITUTIONAL
RIGHT TO TRAVEL (S)

PRINT ABSTRACTS=A//#       NEXT=B OR B//#          END INQUIRY=C
(C)NYTIMES. SEE ABSTRACT FOR YEAR. NONTIMES MATERIAL BY PERMISSION
  11 OF    15 NYT/JNL 1975- 8-25     :     18:  3 4/WGT  20/LIN
   237-75-78                              1009376/IDN
ATTYS MALCOLM MISURACA AND DR ROBERT H FREILICH CRITICIZE US CT
OF APPEALS FOR 9TH CIRCUIT FOR APPROVING POPULATION LIMITATION
PLAN FOR PETALUMA, CALIF; SAY CT TOOK UNDULY NARROW VIEW OF
ISSUES IN CASE; PETALUMA ADOPTED PLAN LIMITING SUBDIVISION
CONSTRUCTION TO 500 UNITS PER YR FOR 5 YRS; DEVELOPERS AND
CIVIL RIGHTS ADVOCATES SAY PLAN RESTRICTS CITIZEN'S RIGHT TO
TRAVEL AND SETTLE WHERE HE CHOOSES; IN JAN '74, US DIST CT
RULED PLAN INVALID ON RIGHT-TO-TRAVEL ARGUMENT BUT 3-JUDGE
APPELLATE PANEL REVERSED RULING AND SAID IT WAS VALID USE  OF
PETALUMA'S ZONING POWER TO LIMIT GROWTH; PLAINTIFFS WILL APPEAL
TO US SUP CT; MISURACA WAS ATTY FOR PLAINTIFFS IN PETALUMA
CASE, AND FREILICH, PROF AT UNIV OF MO LAW SCHOOL, WAS COUNSEL
FOR RAMAPO, NY, IN ANOTHER LANDMARK CASE IN WHICH NYS CTS
UPHELD RAMAPO PHASED-GROWTH PROGRAM; FREILICH SAYS PETALUMA
PLAN APPEARS TO RESEMBLE THAT OF RAMAPO BUT IS 'A GRAB BAG' AND
THAT CT DID NOT CONSIDER WHETHER PETALUMA WAS TRULY ISOLATED
RATHER THAN AN URBAN GROWTH SITUATION AND DID NOT CONSIDER HOW
MUCH OF COMMUNITY'S LAND WAS OFF LIMITS TO DEVELOPMENT AND HOW
THIS WOULD AFFECT LANDOWNERS; SAYS CASE IS 'TOTAL EVASION OF
THE ISSUES' (M)
```

LAND USE AND ZONING: PETALUMA, CA

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PRINT ABSTRACTS=A//#       NEXT=B OR B//#        END INQUIRY=C
(C)NYTIMES. SEE ABSTRACT FOR YEAR. NONTIMES MATERIAL BY PERMISSION
  15 OF   15 NYT/JNL 1976- 2-26    :    13:  1 4/WGT  10/LIN
    57-76-78                            1100775/IDN
SUP CT REFUSES TO REV CALIF ZONING CASE THAT WOULD HAVE
PROVIDED OPPORTUNITY FOR COMPLETE REV OF CONTROVERSIAL ISSUES
POSED BY GROWING MOVEMENT TOWARD COMMUNITY-IMPOSED ZONING
RESTRICTIONS DESIGNED TO LIMIT A COMMUNITY'S GROWTH; CASE
INVOLVED CONSTRUCTION INDUS ASSN OF SONOMA COUNTY VS CITY OF
PETALUMA; LOWER CTS SUSTAINED GROWTH-RESTRICTION PLAN THAT
LIMITED CONSTRUCTION OF MULTIPLE UNIT HOUSING TO 500 UNITS PER
YR FOR 5 YRS; NEXT WK CT WILL HEAR ARGUMENTS ON ZONING CASE
FROM EASTLAKE, OHIO, BUT HAS NOT YET ANNOUNCED IF IT WILL REV 2
OTHER ZONING CASES INVOLVING SAN DIEGO AND SANTA CLARA (M)
```

Related articles, including the complete version of these abstracts*, may be found in the following references:

Business Week, September 8, 1973
New York Times, February 12, 1974
New York Times, February 12, 1974
New York Times, February 17, 1974
New York Times, April 13, 1974
*New York Times, April 30, 1974
New York Times, July 29, 1974
Wall Street Journal, January 31, 1975
Los Angeles Times, February 25, 1975
New York Times, July 4, 1975
*Wall Street Journal, August 14, 1975
*New York Times, August 25, 1975
New York Times, September 4, 1975
Los Angeles Times, September 8, 1975
*New York Times, February 26, 1976

*Abstracts reprinted with permission from: The Information Bank, 1719A Route 10, Parsippany, New Jersey 07054.

APPENDIX - THE CONSUMER, THE ENVIRONMENT, AND THE AUTOMOBILE

Winston Churchill once said that the worst disaster in the history of mankind was the invention of the automobile. It is possible that many motorists, immobilized during rush hour on a hot summer day, might momentarily agree with him. However, once radiators and tempers have cooled off, the answer would probably be different. Statistics support this conjecture. In a questionnaire circulated a few years ago, people were asked about the automobile — "is it worth it?" Eighty-five percent of the respondents unhesitatingly proclaimed — "yes!"

Other statistics offer proof that the number of automobiles on America's highways is increasing steadily. In 1950, 59 percent of American families owned automobiles. By 1970, the figure had risen to 80 percent. Nearly one-third of those families owned two cars, in part causing the average passenger load per American automobile to drop to 1.2 persons.

The Influence of the Auto on Our Lives

Dependence upon the automobile has led owners to a situation wherein much of their lives is controlled by the auto and activities surrounding it. And it has led them into a vicious cycle. The mobility provided by automobiles has enabled many to live in the suburbs, to patronize shopping centers and drive-in movies, and to spend weekends in the country. But in the process of moving into this lifestyle, the now-familiar urban sprawl has developed and has heightened dependence upon the car. The vicious cycle continues as the number of people involved in plying city streets, in and out of the suburbs, and back and forth from home to open spaces increases. The demand for mobility necessitates the use of the automobile. And yet, ironically, the auto has at the same time become impractical and distasteful. It can no longer be said to provide comfort, convenience, or reliability. Ask the man who spends two or three hours a day commuting on crowded highways or who tries to come home from the beach on a hot Sunday afternoon. And so the once-convenient automobile often betrays the owner. Even more tragic, perhaps, is that it has betrayed the environment.

Examine the chain of events involved in the life of an average car. It would be good to be able to say the life "cycle" of the average car. Unfortunately, it is not always a "cycle." If, upon a car's demise, the materials used in its construction were recovered and reused to make future cars, one environmental problem would be mitigated somewhat. But the thousands of abandoned cars rusting on city streets are testimony that large quantities of potentially reusable materials are wasted. A study of automobiles built between 1954 and 1965 showed that a car weighing 3600 pounds contained about 2500 pounds of steel; 500 pounds of cast iron; 32 pounds of copper; 54 pounds of zinc; 51 pounds of aluminum; and, 20 pounds of lead. These figures, multiplied by all of the cars produced each year, reach a staggering amount. Cars consume approximately 65 percent of all rubber used in this country; 41.2 percent of all iron; 16 percent of all steel; 11 percent of all nickel; 29 percent zinc; 8.2 percent of all aluminum; and 7.8 percent of all copper. Nearly all of these materials are reusable, but they rarely are reused even though technology for recycling these important metals is available. More copper and lead is recycled in the United States than is mined here, and there is a market for these recycled materials.

Why, then do so many abandoned cars (57,000 in New York City in 1967) fill streets, vacant lots, and highways, contributing to the visual blight enveloping our cities and countryside? One reason is that it is not profitable for a car owner to dispose of his automobile in an environmentally sound way. It costs him more to have his car towed away than he realizes for the parts and scrap metal. The problem of the abandoned car is one that has not yet been solved, and until it is, the discarded monuments to the incongruities of our motorized age will be in evidence on street after street. Those that make the junk yards their final resting place are cited in every litany of environmental degradation. Their naked ugliness serves as a reminder of the horrible waste of lives and money, as well as precious metals.

The Cost of the Automobile

No discussion of the automobile is complete without a consideration of cost. The steady streams of traffic that flow among the superhighways extract a toll from a once beautiful landscape. The auto must be fed, housed, and cleaned. Gas stations, service stations, car washes, parking lots, automobile parts stores, and used car lots occupy large expanses of property in every city and town. Highways bisect cities, adding to the sense of alienation associated with the urban scene. Many thousands of acres of crop and oxygen-producing rural land on the edge of cities have been paved with concrete and lined with the service agencies necessary to keep automobiles running.

The greatest cost, however, is in human lives. The automobile is the largest single killer of young people between the ages of 17 and 25 in our nation. The cities reflect the highest fatality rate, 3.5 lives per 10,000 automobiles. The national total for fatalities is over 55,000 annually.

Auto-related costs are staggering. The price of a new car is over one-third of the average yearly family income. One of every four dollars in retail sales is spent on purchases connected with the automobile. Over and above these figures are the costs for insuring and servicing the family car. Hidden costs are equally large. Some of them - policing, road building and repairing, loss of tax revenue on land used for roads and municipal parking lots - are measurable. Costs in the form of harm done to society through air and noise pollution, breakdown of the inner city, and business losses due to traffic congestion in the central business district are rather more difficult to measure. However, their impact is felt by everyone who spends any part of his life in an urban area. Undoubtedly, the most important single harmful effect of of the automobile is on human health. The effects of carbon monoxide from automobile exhaust on the human body are dizziness, headaches, fatigue, irritability, and changes in heart and vascular conditions when continuously exposed to even moderate levels of the gas. At higher levels, people show impaired judgment and coordination. Many automobile accident victims have shown carbon monixide blood levels higher than normal amounts.

Two other pollutants given off in large quantity by automobiles are hydrocarbons and nitrogen oxides, which are especially dangerous when they combine in the presence of sunlight to form photochemical smog. Ozone, a by-product of this reaction, affects lungs, aggravates asthma, and causes headaches and dizziness.

One final link in the chain of harmful environmental effects of the automobile is the impact it is having on the national energy supply. The private car is the least effecient method of transporation, from the point of view of energy consumption. Approximately one-half of the gasoline used in the country is used by cars. Over one-fifth of the total energy supply goes to move the family auto.

Confronted by these problems, most people expect technology to be the solution. We should realize however, that any real progress in mitigating the adverse effects of the auto upon the environment will require changes in attitudes and habits and more serious consideration of alternative means of transportation.

APPENDIX - AUTO USE QUESTIONNAIRE

Instructions: In an effort to better understand the role of the automobile in our lives, complete the following questionnaire about the use of the family car(s). Circle the answers that apply to you.

(1) male female

(2) Number of people over 18 living in your home:

1 2 3 4 5 6 over 6

(3) Number of cars owned by people living in your home:

1 2 more than two

(4) Do you use your car to drive to work or to school?

always sometimes never (I don't go to work or school)

(5) Do you go to work or to school in a car pool?

always sometimes never (I don't go to work or school)

(6) Do you use public transportation to go to work or to school?

always sometimes never (I don't go to work or school)

(7) If you use your car more than you use public transportation, why do you? Circle all which apply.

more convenient cheaper faster safer public trans. not available

(8) How many hours do you spend during the average week in your car?

none 1-5 hours 6-10 hours 10-15 hours 15-20 hours more than 20 hours

(9) How many miles do you drive in an average week?

less than 25 25-30 50-75 75-100 more than 100

(10) When you drive your car, how many passengers do you usually have?

no passengers one passenger two passengers more than two passengers

APPENDIX - AUTO USE IMPACT SURVEY

Below is a list of problems created by the automobile. Using the numbers 1-12, rate them in the order in which you find them undesirable. Number 1 will be the item that you find most annoying.

_____ Abandoned cars are dangerous and an eyesore

_____ Cars cause air pollution.

_____ Highways take the place of farms and forests.

_____ Automobiles cause noise pollution.

_____ Used tires pollute lakes and rivers.

_____ City highways often take the sites of poor people's homes.

_____ People are killed and injured in auto accidents.

_____ Streets are so filled with cars, people can't walk.

_____ The world's supply of gasoline is being used up.

_____ The industries which make automobiles and parts cause air pollution.

_____ Billions of person-hours are lost every year in traffic jams.

_____ 60 percent of the land in and around the cities is used for roads, highways, parking lots, gas stations, used car lots, junked cars, garages, driveways, etc.

After completing the questionnaire, discuss the information in terms of the effect the automobile has on our lives. Is the personal use of a car largely determined by where one lives (city, suburbs, country)? Consider:

- Of the families you know, how many own cars? How many cars does each own?
- Are cars used by these people to go to work or to school? Why or why not?
- Are car pools used very much? Explain. How much is public transportation used? Why?
- What is the average passenger load per car? How does this compare with the national average of 1.2 passengers per automobile?

APPENDIX - PLANETARY CHARACTERISTICS

Planet	Distance from Sun (millions of miles)	Rotation Period	Length of Year	Diameter (miles)	Atmospheric Condition	Approximate Temperature (°C)	Equiv. Wt. of 150 lbs.	Mass Relative To Earth
Mercury	36	59 days	88.0 days	3,000	carbon dioxide	321° to -268°	55	0.05
Venus	67	249 days	224.7 days	7,600	nitrogen? carbon dioxide water	+260° average	130	0.81
Earth	93	23.9 hours	365.3 days	7,900	nitrogen oxygen carbon dioxide water argon	58° to -87°	150	1.00
Mars*	142	24.6 hours	687.0 days	4,200	nitrogen water carbon dioxide	21° to -34°	55	0.11
Jupiter	486	9.8 hours	11.9 years	89,000	hydrogen helium methane ammonia water? neon?	-129° average	380	317.8
Saturn	892	10.2 hours	29.5 years	75,000	similar to Jupiter	-143° average	160	95.2
Uranus	1,800	10.8 hours	84.0 years	30,000	hydrogen helium methane ammonia water? neon?	-184° average	155	14.5
Neptune	2,800	15 hours	164.8 years	28,000	similar to Uranus	-194° average	210	17.2
Pluto	3,700	6.4 days	248.4 years	3,600	unknown	-212° average	unknown	0.8

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*Most recent data: bright sky with pinkish hue, strong winds, sandy, rock-strewn surface, reddish soil, two polar ice caps, low atmospheric pressure, nitrogen 3%, argon 1.5%, probability of free-flowing water earlier in planet's history

APPENDIX - CATEGORIES OF ENVIRONMENTAL ISSUES

Chemical, Biological, and Radiological Contamination

Agricultural chemicals
Pesticides, fungicides, herbicides, insecticides
Metal poisoning
Detergents
Plant and animal diseases
Pests
Mine tailings
Radiation (microwave, etc.)

Consumerism

Packaging
Advertising
Product durability
Consumer information
Impulse buying
Status products

Economic/Social/Cultural Environments

Aesthetics
Lifestyle
Housing
Jobs
Poverty
Trade balances - comparative advantage
Civic responsibility
Cultural identity - assimilation
Cultural identity - pluralism
Communications

Energy

Power generation
Fuel supplies
International trade policies
New systems and concepts (geothermal, solar, nuclear)

Environmental Planning and Design

(See also Land Use and Pollution: Visual/Aesthetic.)

Health

Pollution
Food additives
Drugs
Stress (congestion, population density, competitiveness,)
Recreation and environment

Land Use

Reclamation/flood control
Construction
Strip mining/erosion
Planning
Recreation
Open space/scenic and historic preservation
Real estate
Urban renewal

Natural Environments

Habitats
Endangered species
Communities/ecosystems
Survival

Pollution

- Air
  - Particulates
  - Engine emission
  - Incineration
  - Industrial effluent
  - Smog
- Water
  - Flood control

- Sedimentation
- Thermal discharges
- Soft and solid waste (See also Solid Waste.)
- Agricultural runoff
- Municipal sewage systems
- Limnology

Noise
- Traffic
- Construction
- Industrial

Visual/Aesthetic
- Signs and billboards
- Construction design
- Transmission lines
- Landscape architecture
- Graffiti

Population

- Distribution and density
- Growth rate
- Migration
- Mobility
  - and food supply
  - and resources

Resources

- Recycling
- Renewable
  - Soil
  - Water
  - Forests
  - Fishery and wildlife management
- Nonrenewable
  - Minerals
  - Fossil fuels (See also Energy.)

Solid Waste

- Recycling
- Recovery
- Disposal methods
- Source reduction (packaging)

Transportation

- History
- Mass transit
- Motor vehicles and highways
- Aircraft and airports
- Safety
- Traffic congestion
- New systems and concepts
- Mobility

APPENDIX - ENVIRONMENTAL EDUCATION PERFORMANCE INDICATORS (Outcomes)

The Performance Indicators (Outcomes) listed below are written in somewhat broader terms than those found next to the Procedures in each Unit. They may be useful as they are stated, or they may serve as a guide to the development of the instructor's objectives for the course. These indicators may also be helpful in assessing overall student achievement as a result of participation in the course.

(1) Identify the problems affecting society's environment, through reading, investigation, and reporting.

(2) Relate data from other disciplines to the subject area in which an environmental problem is studied.

(3) Analyze and interpret the decisions society makes affecting the environment.

(4) Identify and enumerate a society's values that affect the environment.

(5) Demonstrate a grasp of the principles and generalizations of an ECOSYSTEM.

(6) Identify problems which occur as a result of population growth.

(7) Analyze the effects of urbanization of the environment.

(8) Discuss the limitations and restrictions society places upon itself in the name of survival. (e.g., limitations on disposal of private property).

(9) Identify the historical basis for the current condition of the environment.

(10) Demonstrate an awareness of local, state, and national efforts to protect the environment.

(11) Prepare simple questionnaires for gathering information about community reactions to local environmental problems.

(12) Develop a means to share environmental information with schoolmates, parents, and community.

(13) Cite common factors in local, national, and international environmental concerns.

(14) Design and test hypotheses to explain environmental problems in the community.

(15) List 10 of the world's most serious environmental problems.

(16) Contrast the use of the environment by peoples of other times and places with present use.

(17) Describe some of the governmental processes (local, state, Federal) which influence the quality of our environment.

(18) Explain how different cultures influence the physical factors in the environment.

(19) Demonstrate an awareness of environmental problems by recognizing them in the community and by reacting to news items about them.

(20) Initiate letters to local officials and newspaper editors suggesting solutions for local environmental problems.

(21) Conclude that America, as a leader in technological advancement, is obliged to help the world meet its energy and food needs.

APPENDIX - ENVIRONMENTAL EDUCATION PERFORMANCE INDICATORS (Outcomes)

(22) Show a concern for the welfare of the starvation-level nations by contributing money and non-perishable foods through local or national charitable organizations.

(23) Recognize and describe the limits of the earth's energy resources.

(24) List and describe present and alternative sources of energy.

(25) Make informed judgments on energy sources in terms of environmental impact.

(26) Communicate concerns for the environment.

(27) Recognize the need for open space and identify the trade-offs that would be required.

(28) Identify attitudinal changes toward environmental problems.

(29) Participate in action programs planned to counter a specific environmental problem.

(30) Critically examine the ecological implications of technological "advances" before endorsing them (examples: SST; catalytic converters; geothermal energy; etc.).

(31) Analyze options and select those least harmful to the environment.

(32) Record, document, and report observations of environmental issues.

(33) Demonstrate a willingness to forego enjoyable activities that upset the environment.

(34) Defend "concerns" for the environment.

(35) Refrain from abusing public parks and areas.

(36) Dispose of wastes more intelligently and consider long-range consequences to the environment.

(37) Differentiate between renewable and nonrenewable resources.

(38) Categorize the world's resources as renewable or nonrenewable.

(39) Discuss the ramifications of continued "unlimited conspicuous consumption."

(40) Relate consumption habits to resource depletion.

(41) Identify some renewable and nonrenewable resources in danger of depletion or extinction.

(42) Explain the purpose of resource management.

(43) Promote the elimination of wasteful consumption habits pertaining to nonrenewable resources.

(44) Analyze the problems affecting the environment.

(45) Defend and support with facts a position taken concerning possible solutions to an environmental problem.

(46) List and describe pollutants of the environment.

(47) Identify and assess the impact of technology on the environment.

(48) Demonstrate an awareness of the importance of the oceans in the biosphere and the current and future efforts that will be needed to protect them.

APPENDIX - ENVIRONMENTAL EDUCATION PERFORMANCE INDICATORS (Outcomes)

(49) Design a problem-solving approach to an environmental problem.

(50) Explain how the physical factors in human environments influence culture.

(51) Construct an "Environmental Bill of Rights" and an "Environmental Bill of Responsibilities."

(52) Recognize visually attractive patterns in nature and utilize them as a design for manmade products.

(53) Define and give examples of the following terms: interrelationship; adaption; succession; scarcity; survival; prey-predator relation; competition; diversity.

(54) Recommend specific resource material (books, magazines, governmental publications) for obtaining information about environmental issues.

(55) Cite some methods that can be used to recover, reuse, or recycle waste or unused materials.

(56) Specify actions which could minimize the necessity to recover, reuse, or recycle wasted materials.

(57) Construct at least three reusable items from discarded materials.

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Academic Press, 111 Fifth Avenue, New York, New York 10003

Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213

Alt Associates, 55 Wheeler Street, Cambridge, Massachusetts 02138

American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005

Ballantine Books, Inc., 101 Fifth Avenue, New York, New York 10003

Ballinger, East Washington Square, Philadelphia, Pennsylvania 19105

Bantam, 414 E. Golf Road, Des Plaines, Illinois 60016

Boston University Film Library, P.O. Box 286, Boston, Massachusetts 02117

Boxwood Press, Box 7171, Pittsburgh, Pennsylvania 15213

Bureau of Land Management, Dept. of Interior, 18th and C Streets, NW, Washington, D.C. 20240

Chevron Chemical Co., 200 Bush Street, San Francisco, California 94120

College of Environmental Science, Syracuse, New York 13214

Columbia University Press, 136 S. Broadway, Irvington-on-Hudson, New York 10533

Consumer's Union of the United States, Inc., 256 Washington Street, Mount Vernon, New York 10550

The Council on Economic Priorities, 84 Fifth Avenue, New York, New York 10011

Crowell, Thomas Y., 201 Park Avenue South, New York, New York 10010

Crown, 419 Park Avenue South, New York, New York 10016

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Educational Facilities Laboratory, 850 Third Avenue, New York, New York 10022

Energy Research & Development Administration, Washington, D.C

Environmental Protection Agency, Washington, D.C.

ERIC Information Analysis Center for Science, Mathematics and Environmental Education, 1800 Cannon Drive, 400 Lincoln Tower, Columbus, Ohio 43210

Fawcett, 1515 Broadway, New York, New York 10036

Federal Energy Administration, Washington, D.C.

Ferguson, J.G. Publishing Co., School & Library Department, 6 North Michigan Avenue, Chicago, Illinois 60602

Finley, Stuart, 3428 Mansfield Road, Falls Church, Virginia 22041

Foreign Policy Association, Inc., 345 46th Street, New York, New York 10017

Funk & Wagnalls, 6661 Fifth Avenue, New York, New York 10019

Glencoe Press, 866 Third Avenue, New York, New York 10022

Good Life Press, 5909 Melrose Avenue, Hollywood, California 90038

Goodyear, Salt Lake City, Utah 84118

Government Printing Office, Washington, D.C. 20402

Grossman, 625 Madison Avenue, New York, New York 10022

Harcourt Brace Jovanovich, Inc., 757 Third Avenue, New York, New York 10017

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Indiana University Film Library, Tenth & Morton Streets, Bloomington, Indiana 47401

Institute of Scrap Iron & Steel, Inc., 1729 H Street, NW, Washington, D.C. 20006

Johns Hopkins Press for Resources for the Future, Baltimore, Maryland 21218

Knopf, A.A., Inc., Random House, Inc., 201 E. 50th Street, New York, New York 10022

LaMotte Chemical Products Co., Educational Products Division, Chestertown, Maryland 21620

League of Women Voters, 1200 17th Street, NW, Washington, D.C. 20036

Little, Brown and Co., Inc., 34 Beacon Street, Boston, Massachusetts 02106

Lothrop, Lee, and Shepard Co., 105 Madison Avenue, New York, New York 10016

Macmillan Co., 866 Third Avenue, New York, New York 10022

McGraw-Hill Book Co., Princeton Road, Hightstown, New Jersey 08520

McKay, David, 750 Third Avenue, New York, New York 10017

Modern Talking Picture Service, 315 Springfield Avenue, Summit, New Jersey 07901

Morrow, William & Co., 105 Madison Avenue, New York, New York 10016

Mosby, C.V., 11830 Westline Industrial Drive, St. Louis, Missouri 63141

National Association of Conservation Districts, 1025 Vermont Avenue, NW, Washington, D.C. 20005

National Audubon Society, Educational Services, 950 Third Avenue, New York, New York 10022

National Education Association Publication Sales, 1201 Sixteenth Street, NW, Washington, D.C. 20036

National Science Teachers Association, 1201 16th Street, NW, Washington, D.C. 20036

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National Wildlife Federation, 1412 16th Street, NW, Washington, D.C. 20086

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NBC Educational Enterprises, 30 Rockefeller Plaza, New York, New York 10020

Nelson Hall, 325 W. Jackson Blvd., Chicago, Illinois 60606

New York City Environmental Protection Administration, New York, New York

New York State Department of Environmental Conservation, Albany, New York 12201

New York State Education Department Albany, New York 12234

New York State Public Service Commission, Central Library, Empire State Plaza, Albany, New York 12223

Newspaper Enterprise Association, Inc., 230 Park Avenue, New York, New York 10017

Norton, W.W. & Co., Inc., 500 Fifth Avenue, New York, New York 10036

Pegasus Books, 850 Third Avenue, New York, New York 10022

Popular Science Publishing Co., 355 Lexington Avenue, New York, New York 10017

Public Affairs Committee, Inc., 381 Park Avenue South, New York, New York 10016

Random House, Inc., 201 East 50th Street, New York, New York 10022

Saunders, W. Washington Square, Philadelphia, Pennsylvania 19105

Schloat Productions, Pleasantville, New York 10570

Scott, Foresman & Co., 1900 E. Lake Avenue, Glenview, Illinois 60025

Scribner's, Charles, Sons, 597 Fifth Avenue, New York, New York 10017

Sea Grant Association, Washington, D.C.

Seabury Press, 815 Second Avenue, New York, New York 10017

Shell Film Library, 1433 Sadlier Circle, West Drive, Indianapolis, Indiana 46239

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Sierra Club, 1050 Mills Tower, 220 Bush Street, San Francisco, California 94104

Signet Science Library, 1301 Avenue of the Americas, New York, New York 10019

Silver Burdett Co., 250 James Street, Morristown, New Jersey 07960

Sinauer Associates, 20 Second Street, Stamford, Connecticut 06905

Sperry Rand, Vickers Division, Troy, Michigan 48084

Syracuse University Film Library, 1455 East Colvin Street, Syracuse, New York 13210

Tennessee Valley Authority, Evans Building, Knoxville, Tennessee 37901

Time-Life, 43 W. 16th Street, New York, New York 10011

United States Department of the Interior, National Park Service, Washington, D.C. 20240

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Urban Systems, Inc., 1033 Massachusetts Avenue, Cambridge, Massachusetts 02138

Vocational Guidance Manuals, 235 E. 45th Street, New York, New York 10017

Wadsworth Publishing Co., 101 Davis Drive, Belmont, California 94002

Washington Tapes, 5540 Connecticut Avenue, NW, Washington, D.C. 20015

Wiley, John & Sons, Inc., 605 Third Avenue, New York, New York 10016

Wilson, H.W. 950 University Avenue, Bronx, New York 10452

Worldwatch Institute, 1776 Massachusetts Avenue, NW, Washington, D.C. 20036

APPENDIX - EVALUATION/RESPONSE SHEET

Instructions: Circle the numbers of the units used and, to the right of each, provide the information asked for in the column heading. (Your cooperation in helping us assess the extent and effectiveness of environmental studies programs in the State will be greatly appreciated.)

Unit	Time spent (days, weeks)	% of material on topic this unit represented	% of material on topic from other sources	Test given on unit (yes/no)	Unit effectiveness on a scale of 1 (high) to no. of units used (low) in the opinion of:	
		100%			teacher	students
1						
2						
3						
4						
5 (I)						
5 (II)						
6						
7						
8						
9						
10						
11						
12						
13						
14						

Please attach any remarks you may wish to make concerning the syllabus, e.g., regarding: judging student performance; locating resources; scheduling difficulties; subject areas coordination; using the unit procedures; etc. Mail evaluation sheet and remarks to: Bureau of General Education Curriculum Development, The State Education Department, Albany, N.Y. 12234.